Nature Magazine

VOLUME 44 NUMBER 5

MAY, 1951
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11. *Babes in the Woods:* The life of Nature's young in the wild.
12. *Wild Animal Pets:* A naturalist's dog into whose life came many strange animals.
13. *Renting Houses for Songs:* An intimate study of bird life.

GROUP II: A spectacular series of Alaskan reels.

21. *Cruising North:* Murres, sea puffins, bear and other coastal wildlife.
22. *Off to Glacier Bay:* Spectacular pictures of the face of a glacier breaking off and plunging into the bay. Also wildlife scenes.
23. *Wild Animal Outposts:* Hardy Island deer, ptarmigan, bear cubs, blue fox, fur seals of the Pribilofs.
24. *Thar She Blows:* Whales at sea.
25. *Great Bear of Alaska:* Films of the great Kodiak bears of Admiralty Island.

GROUP III: Southwestern series.

31. *Wings to the South:* Bird life of the Texas Gulf Coast and the southwest.
32. *Riding the Rimrock:* Searching the rough country of the southwest for its wildlife.
33. *Nature's Side Show:* The struggle for existence in the arid southwest.
34. *Queer Creatures of the Cactus Country:* A study in the adaptation of wildlife to a harsh land.
35. *Getting Personal with Mountain Lions:* A thrilling picture of a pack trip into lion country.

GROUP IV: Photographed along the Continental Divide.

41. *The Big Game Parade:* You meet Antelope, Mountain Sheep, Mule Deer, Elk, Bison, Moose, Brown Bears and Grizzlies.
42. *The Forests:* Forest Fires, Birds, Beaver — greatest conservationist of all — at work.
43. *When Mountains Call:* The life of the high places is thrilling to see. Water Ouzel, Ptarmigan, American Eagle, Big Horn Sheep, Wapiti — American cousin of the European Stag.
44. *Ramparts of the North:* Filming big game requires endurance. Glaciers, Hoary Marmot, Caribou, Moose, Black Bear.
45. *Getting Our Goat:* Mountain Goat on its native crags. Ground Squirrels, Cony, Grouse.

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Wilderness Trails

Again this year H. Frank Evans is conducting his Wilderness Trail Trips in Glacier National Park, trips on which a number of members of the American Nature Association have had fine vacations. The trips are not too strenuous for any reasonably competent outdoor person, and they take the participants into some of the most glorious country in the West, away from the masses of visitors. The trips are for ten days and four trips are scheduled. Full details from H. Frank Evans, Panorama Ranch, Belton, Montana.

Conservation Tour

Announcement of a nation-wide conservation tour by bus is made by the College of Agriculture, University of Connecticut, Storrs, Connecticut. The trip will get under way June 27 from Storrs, will cover about 12,000 miles and take two months. A traveling kitchen will accompany the bus, and other traveling facilities will be provided. Full details are available from Dr. Raymond Kienholz, Coordinator, University of Connecticut, Storrs, Connecticut.

Hackensack Swamp

For a long time Hackensack Swamp has been the home of herons, egrets, bitterns and many other forms of wildlife. Now the Spring Valley (New York) Water Works and Supply Company has petitioned the New York State Water Power and Control Commission for approval of a plan that would flood a large part of the area and create a lake one-half mile wide and five miles long. The habitat of the resident wildlife would largely be obliterated. Fighting the proposal are the Rockland Audubon Society and the Rockland County Conservation Association. Help is asked through registering opposition with Perry B. Duryea, Conservation Commissioner, Arcade Building, Albany, New York.

For Gem Hunters

Gem Hunter's Guide. By Russell P. MacFall. Chicago. 1951. Science and Mechanics Publishing Company. 187 pages. Illustrated. $3.00.

With the amazing increase in the interest in amateur lapidary work as a hobby and a sideline source of income, there has come, also, increase in the number of gem hunters, or rock hounds, as they usually call themselves. With this has come the realization that gem stones are not minerals always imported from far places but that gems are to be found all over the United States by those who know where to look, and how to recognize what they have found. The author discusses, first, the gem stones, then how to find them, and, finally, where they have been found. A glossary, list of sources of information, and a bibliography are provided.

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Nature In Print

By HOWARD ZAHNISER

FROM ENGLAND, through American publishers, four works of fiction, by chance or possibly by someone's choice, have found their way to my Nature in Print shelf during the past year, or so, and now lie here before me—all read, each enjoyed in some measure, and each one seemingly worthy of the attention of others.

Three of them have not only been written in England, but also have the scene of their fictional events in that land — two on the east coast and one in the "west country." The fourth is a story of the central African bush country. All are concerned with men and the various outdoor creatures, but two are focussed more sharply on a striking bird — *The Awl-Birds* on the avocet, *The Phasian Bird* on a rare and colorful hybrid pheasant. One is essentially a dog story, the principal animal of which is its title character, *Storm of Dancerwood*. The fourth is *Wind Runner: The Story of An African Antelope*.

Here they lie on the table — J. K. Stanford's silver gray volume with A. M. Hughes's gold-stamped drawing of an avocet, "the awl-bird," down at its right front corner; Henry Williamson's bright red novel with its pheasant by Israel Daskow, also in gold, on its front cover; Joseph E. Chipperfield's ever so blue book with Helen Torrey's drawing of Storm running in red ink across its front; and G. W. Barrington's apple green volume with his own maroon-drawn impala leaping away into space.

Here, too, are the jackets of the books in a bright heap to themselves off to one corner — *The Awl-Birds* jacket neat and exquisite with its distinctive typography and the black-and-white drawings of its avocets; *The Phasian Bird*'s dark cover with the pheasant in gold framed on its front; Storm limned large on the horizon against an aqua blue sky; and the bright yellow jacket of *Wind Runner* with its graceful antelope standing on the green of a landscape.

How important all this color is; how important also these drawings! How seldom one thinks to mention (yet how often one delights in) such raiment for good books. The drawings that aid the imagination and please the reading eye likewise are too often untold in one's account of a book.

Ah, but the story's the thing — or is it? — and here in these four works of fiction are as many uses of wildlife for the purposes of a humanly engrossing tale.

Simplest and in many ways the best of all is Mr. Barrington's *Wind Runner*. The charm of the antelope that it takes for hero, the exotic interest of its African setting, the timely interweaving of human and wild-creature interests — all have a part in a story that is straightforward and unassuming, for the most part the story of an animal for its own sake. Could you, gentle reader, have seen on recent evenings this book heard by my own four listeners — 13 and 5, 10 and 7 in age — and noted also the reader's own pleasure, you would, I have no doubt, have certainly reached for it yourself.

Mr. Barrington like many others — including myself, alas — might well for the reader aloud, and for the younger reader, content himself with sentences shorter and more direct, if not so well constructed. Here, for example — and one taken somewhat at random — is a sentence which says: "As evening drew near the impala began to move off in the direction of a nearby watercourse, or donga, their example being followed by other herds in the vicinity until the whole army of beasts was on the move, all dominated by a common desire for water, and all desirous of obtaining it before nightfall." Four sentences I make of this as I am reading it aloud. Periods seem to fall naturally after "donga," "move," and "water," and each of the four sentences in my aloud-read translation gains its verb — "was followed," "were dominated," "were desirous." (Reading aloud should prove an excellent test for any such story meant either for quick reading or for children.)

Storm of Dancerwood is a tale of a dog and men, especially a particular man. It is the story of a dog that was called into the wild and there for a time shared the life of the wild creatures. There for a time, so this story goes, the dog Storm consorted with a blind vixen and used his cunning to lead the pack of hounds on occasion away from the hunted foxes. In the end this is the story of the call of a man for this dog, a call that proves stronger than the call of the wild, even.

The Awl-Birds and *The Phasian Bird* — in contrast with *Wind Runner* and *Storm of Dancerwood* — are essentially literary works addressed to an adult audience.

J. K. Stanford tells us in an author's note to *The Awl-Birds* that he was "lucky enough to be present at the finding of the first eggs" when avocets bred on the East Coast of England "after a lapse of more than a hundred years." The intense story he has created out of his own experiences thus suggested has apparently a moral purpose to help sustain the presence of these birds — "to make sure that neither our own slackness and folly, nor the malice of private individuals, banishes them ever again." But to many a reader it will well serve an exciting reading purpose as fiction of the first rank, and three readings of my own have not been enough to exhaust either my interest in its subject or in the skill of its author's telling.

The Awl-Birds is not a story of wildlife as is *Wind Runner* essentially, nor a story about animals and men as is *Storm of Dancerwood*. Rather it is in essence a tale of men, of human characters and their actions as focussed upon or affected by certain birds. So also in a way is Henry Williamson's full-length novel which he calls *The Phasian Bird*. Yet Mr. Williamson's interest is so broad that it seems to encompass man and bird and landscape too — the whole of the life of the time of the tale, in fact. It is at first a slow-moving, highly descriptive, contemplative narrative. We see in its pages not only the colorful pheasant of great beauty and of a surmised symbolism, with its wildling associates, but also the man and men who aspire to a noble husbandry of the farm lands where the Phasian bird ranges. We see these fields in the days of the world war that was waged to so great an extent in heavens above England. And, as the pace of the narrative quickens, we realize in our suspense that we are looking on the scenes of contentions that are profound and universal.

In fiction a mere man can order events and shape destiny. In fiction, although facing an inescapable obligation to the credible, a man can shape a tale to his own concept of truth, and a reader

The Elder Tree

By MAUDE WOOD HENRY

A forester once felled an elder tree
And marveled at the wood, in which he said
Were stains like blood — in every branch that he
Cut into were these spots of carmine red.
Time passed and one day chancing on a book
Of ancient myths, he wondered there to see
That he who felled box elder also took
The life of some fair spirit of the tree.
'Twas dryad's blood that gave the wood its stain,
That dyed the trunk and dripped through every limb;
Unknown to him a wood nymph he had slain,
Which made — he shuddered — murderer of him.

can see it whole. Whether in the reading aloud of *Wind Runner* to children in the receptive bedtime world, when I seem to understand so easily the impala antelope of Africa, or whether in pondering *The Phasian Bird*, when I apprehend through such darkness "that magnanimity, or greater love, which must be shown to all men, to friends and to enemies alike," I am conscious of my debt to the art of fiction and its artists. Ever and anon I make a payment on this debt as best I can.

Storm of Dancerwood. By Joseph E. Chipperfield. New York and Toronto: Longmans, Green and Co. 1949. 309 pp. (5½ by 8x in.), with end papers and 22 other drawings by Helen Torry. $3.

The Awl-Birds. By J. K. Stanford. New York: The Devin-Adair Co. 1949. 90 pp. (6 by 9⅛ in.), with an introduction by Helen G. Cruikshank and end-paper "Plan of the Bledgrave Marshes" and 29 drawings by A. M. Hughes. $2.

The Phasian Bird. By Henry Williamson. Boston: Little, Brown and Co. (An Atlantic Monthly Press Book) 1950. 276 pp. (5½ by 8x in.), with title-page and 25 chapter-head drawings by Israel Daskow. $4.

Wind Runner. The Story of An African Antelope. By G. W. Barrington. New York and Toronto: Longmans, Green and Co. 1951. 160 pp. (6⅛ by 8½ in.), with 17 drawings by the author. $2.50.

The Pacific

Geography of the Pacific. Edited by Otis W. Freeman. New York. 1951. John Wiley and Sons. 573 pages. Illustrated. $10.00.

Contributors to this volume, besides the editor, are thirteen specialists on the Pacific area. They collaborate to provide a comprehensive and authoritative book on this area, its ocean, islands, people, resources and industries. Economic developments, human relationships, politics and current problems are considered and, emphasis is placed on the Trust Territories.

Mexico's Hunger

Land Hunger in Mexico. By Tom Gill. Washington, D.C. 1951. Charles Lathrop Pack Forestry Foundation. 86 pages. $2.00.

This is a significant, startling and sad book. Its factual yet astonishingly readable story of the abuse of land in Mexico, the impact of excess population and human superstition upon attempts to solve the problem, the woeful inadequacy of such remedial steps as have thus far been taken, and the basic relationships between man and the land that are set forth, make this discussion most important. Not only is Mexico hungry for arable land, which never can be provided until flood and erosion protection is assured, but Mexico is a thirsty land, with water — or the lack of it — lying at the very heart of the country's agricultural problem.

Mr. Gill, who has been an officer of the Charles Lathrop Pack Forestry Foundation for more than twenty years, has specialized in tropical foresty problems. In this book he writes a straightforward story of conditions in Mexico, doing so in a way that holds the reader until the end. It is to be hoped that the Spanish edition will reach those in Mexico in a position to move more rapidly and more extensively to meet the situation and to apply to the fullest the obvious remedies. Certainly Mr. Gill shows what has happened and what must be done.

Blue Ridge Trails

Guide to Paths in the Blue Ridge. Washington, D. C. 1951. Potomac Appalachian Trail Club, 1916 Sunderland Place, Washington 6. 900 pages. $4.25.

This is a guide for the hiker and camper using the central portion of the Appalachian Trail and numerous side trails in that area. The guide covers 76 miles of trail in southern Pennsylvania, 37 miles across Maryland and 502 miles through the Virginia mountains to the North Carolina border. No details that the trail user would need appear to have been overlooked.

Plant Pathology

Plant Pathology. By John Charles Walker. New York. 1950. Mc-Graw-Hill Book Company. 699 pages. Illustrated. $7.50.

This is a general text designed as a basic introduction to plant pathology and directed to the student in agriculture or botany entering this or allied fields. This volume is the latest addition to McGraw-Hill's series of Publications in the Agricultural Sciences.

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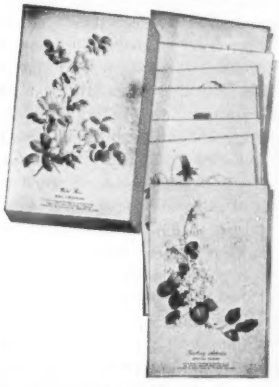

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- ☐ **Flower Prints**
- ☐ **Audubon Bird Prints**
- ☐ **Butterflies, Moths, Flower Prints**

If you do not wish to mutilate your copy of the magazine, and write separately, be sure to describe fully items desired.

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STREET and No. .....

CITY ..... **Zone** ..... **State** .....

By Way of Report

The Sixteenth North American Wildlife Conference

By HARRY E. RADCLIFFE,
Vice-president of the American Nature Association

REPORTING on a National Wildlife Conference is like attempting to cover a three-ring circus with each ring under a separate tent. With three general sessions in three days; two technical sessions on each of these days; and thirty-six related meetings of cooperating professional, conservation, scientific and educational organizations, all taking place in this short space of time, one individual is attempting the impossible in trying to cover everything. We all must rely for full details on the complete *Proceedings*, to be published later by the Wildlife Management Institute, sponsor of the Conference.

Any report, if confined to small space, must be terse. Here sentences must take the place of paragraphs; words, if possible, carry the impact of sentences; the occasional discord and disagreement blended into a final statement that will represent the essence — the end product of this conference, namely, the need of a National Land and Water Resources Policy for this country.

There were fourteen outstanding papers on land and water resources; forty-two technical papers on game-management problems, applying conservation knowledge, and related subjects. Harrison F. Lewis, Chief of the Canadian Wildlife Service, pointed out "that a community, as Leopold has emphasized in his writings, includes not only people, but also soils, waters, plants and animals of all kinds. . . The optimum value of each wild species must be determined with reference to its place in the general scheme, or, in other words, be fixed in consequence of ecological considerations.

"A large part of animate creation is concerned with little beyond making a living and reproducing its kind. Widespread among mankind, however, is the more or less conscious realization that making a living is only a preliminary; that beyond it lies, for those who accept it, the greater experience of *living a life*. And aesthetic and recreational values are primarily concerned with *living a life*. They are essential to real living. They upbuild the persons who assimilate them. They increase ability to perceive and comprehend. They are essential to the sound development of society. In comparison with economic values they take no second place." It is to this philosophy that the American Nature Association is dedicated.

Dr. Paul B. Sears, Chairman of Conservation Program, Yale University, declared that "what is required is more and better conservation education. This is ill expressed by crusaders whose ideas too often are expressed in 'bemoaning of the past, feeling sorry for the passenger pigeon, the auk, or the buffalo' and overlooking the economic need, the destruction of habitat necessary for the economic development of the country. Conservation means 'to save,' but as applied to present day problems it more accurately means the wise management and use of our natural resources. Our individual and national wealth originates with these resources." Dr. Sears cautioned that, with steadily increasing pressure of human population on limited space and resources, we should think of the living communities of plants and animals, highly organized, each component playing its role, and the whole operating efficiently to regulate the water cycle, stabilize the land surface, build soil, store energy, and produce organic material. It would seem unwise to disturb this highly organized biological environment too violently, but rather to conserve habitat and wildlife.

Melvin O. Steen, Chief of the Fish and Game Division of Missouri, declared: "The average American does not fully understand the real significance nor the proper use of water and land resources, and, as a consequence, we do not conserve them, we only conserve our private right to exploit them. . . Money is not wealth but only a medium of exchange. Wealth consists of natural resources plus human effort, and it is this great storehouse of natural resources plus an energetic and ingenious people that have made this Nation what it is today. Therefore, it is imperative that we conserve both our natural resources and our will to work. We must embrace and execute a new and revolutionary ideology. We must get our horse out in front of the cart. We must think and act in terms of biological facts and biological soundness rather than only in terms of economics and dollar yield. Only sound biology can give us sound economics."

The quality of papers delivered to the Conference was high. There was occasional disagreement and slight discord, which is always a healthy sign, but the underlying theme carried through to a fitting climax — a recognition of the need for a genuine land and water resources policy for the United States. Thus far there has been no such policy. True enough, there have been temporizing plans, some of them good for a time, and for certain sections. But a plan involving and comprehending the welfare of the whole nation, and adapted to fit the different parts of the country, is still lacking.

Leading conservation organizations have reached some understanding with respect to a declaration of objectives and principles that should be followed by federal and state governments. It remains for the Congress to enact legislation embodying broad declarations of land and water resource policy and directing executive agencies to bring their respective programs into conformity with this declaration of policy.

Contents Noted

RESTRICTION of cats in the interest of preservation of song and insect-eating birds is the objective of a bill introduced into the California Legislature by Assemblyman Lester T. Davis. The bill provides penalties for allowing a cat to run at large off the premises of the owner, for using devices to attract birds and then allowing a cat to run at will, and for abandoning a cat to fend for itself. The bill also would prohibit cats in public parks, bird sanctuaries, or preserves unless under the immediate control of its owner or keeper. The measure was introduced at the instance of Miss Gertrude Charny, who also fostered such a measure in Illinois. The Illinois bill was passed by both branches of the Legislature but was vetoed by the Governor. There is no question but that free-roving cats *do* account for many young birds during the nesting season, and thus deprive us of the cooperation of insectivorous birds in keeping insects in check. Cat lovers will rise in wrath at such restrictive legislation, of course, but there is no blinking the fact that the cat is, basically, predatory. It should not be allowed the exercise this instinct at times of year when it can be, and is, most destructive.

CONSERVATIONISTS applauded the order signed on February 21 by Secretary of the Interior Oscar L. Chapman and affecting water-control investigations in national parks, wilderness areas and wildlife refuges. Under its terms "no bureau, service or agency within this Department shall henceforth undertake or continue, within or affecting any national park or monument, without the written approval of the Secretary of the Interior, any investigations or studies, or undertake any drilling, surveys, or other exploratory work incident to the preparation of reports or plans relating to water development, or obligate any Federal funds therefor, except where the Congress has specifically authorized such a project in the reserved area concerned." This provision is also extended to include national wilderness areas and wildlife refuges. Another section of the order provides that where proposed power and reclamation projects appear in the public interest, alternative project possibilities shall also be submitted. The effect of this order is to forestall studies in reserved areas, and to prevent such studies being carried too far before other agencies concerned are taken into confidence.

EXTENSION of protection to include the bald eagle in Alaska is again sought from the 82nd Congress. Congressman Homer Angell of Oregon has introduced H.R. 1870 for that purpose, and the bill has been referred to the House Committee on Merchant Marine and Fisheries, of which Congressman Edward J. Hart of New Jersey is chairman. The bill protecting our national bird in the Territory of Alaska, where it has a bounty price on its head, was passed by the House during the 81st Congress, but was not reported by the Senate committee that had it in charge. Evidence submitted at a hearing on the bill was mainly on the side of the eagle, and there seems to be no valid excuse for its continued persecution in Alaska.

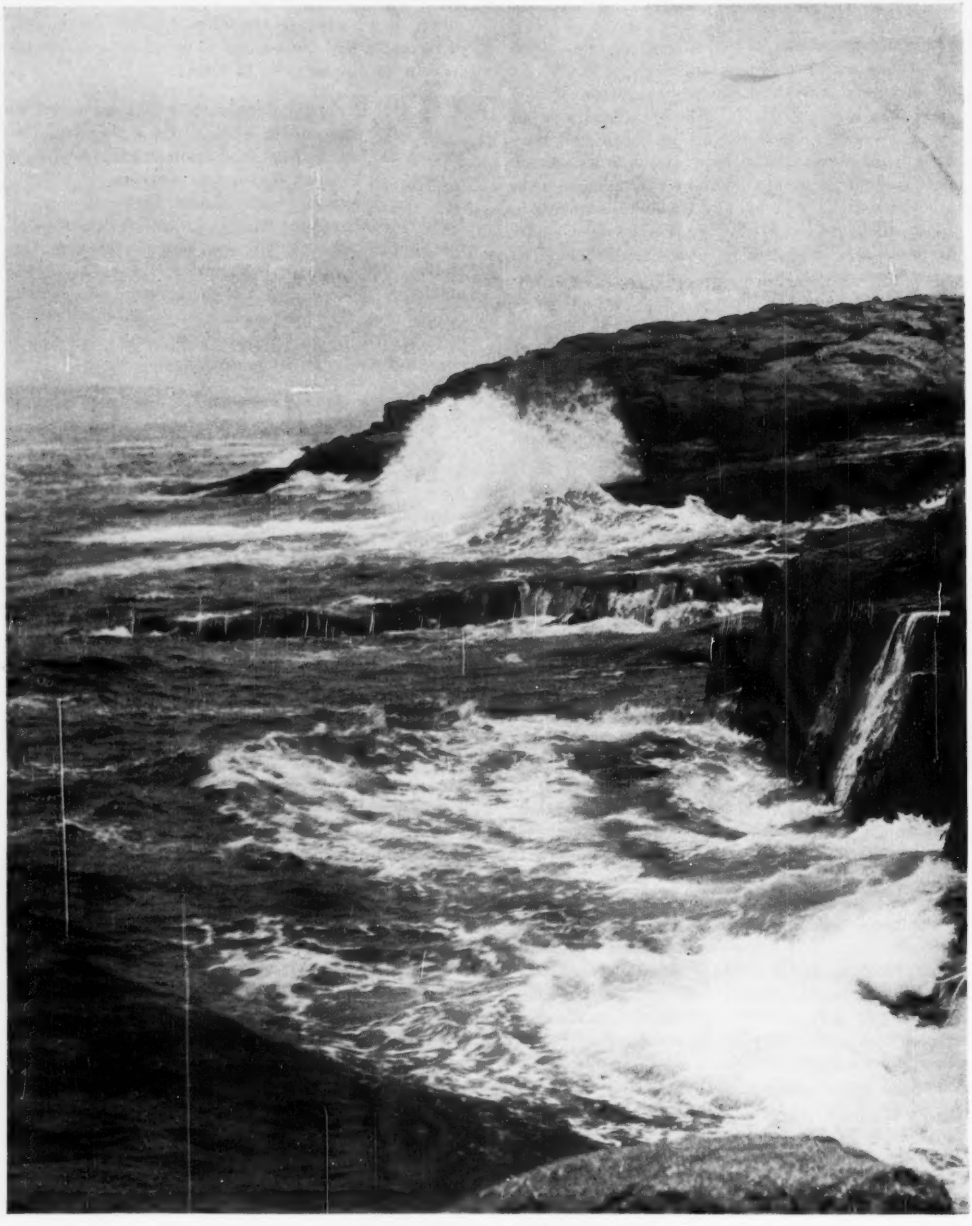
IN SOUTH Park, Pittsburgh, there is a memorial to the great poet, Joyce Kilmer. On a plaque are inscribed the famous lines from his immortal poem,

"I think that I shall never see
A poem lovely as a tree."

Elms grew around the memorial, obscuring the view of this poetic sentiment. So, with straight faces and the absolute minimum of imagination, the county commissioners decreed that two-thirds of the trees should come down. The sarcastic laughter that this decision brought from people far and wide quickly resulted in a change of plan. The elms still stand.

IT IS fitting that we should say a word here by way of congratulation to a distinguished fellow publication just celebrating its Golden Anniversary. We refer to *Readers' Guide to Periodical Literature*, published for the past half-century by the H. W. Wilson Company. The sometimes wise words and valuable information published in *Nature Magazine* are indexed in this important reference work to the better publications.

READING and assimilating the imposing three-volumes of The President's Water Resources Policy Commission report in its entirety, and in thorough-going fashion, would virtually require a sabbatical leave from one's normal activities. We are gradually working our way through this document, although we shall undoubtedly be content to leave the third volume, which deals with law as it affects water resources, for reference purposes. Volume One, which is concerned with "A Water Policy for the American People," is extremely interesting, although somewhat disappointing in various respects, especially in its treatment — or relative lack of treatment — of the National Park idea or ideal. The second volume, entitled "Ten Rivers in America's Future," is more readable than the first volume, perhaps because it deals with the watersheds of these ten specific rivers and presents a discussion of their management for their water resources and related natural assets. What the general circulation of these reports may be — the three volumes cost $11.50 all together — we would not wish to guess. Nevertheless, informed citizens should know something of what this Committee is getting at, and gain at least a basic picture of the considerable task that was done. This is possible through a fourth publication of eighteen pages, which is a "Summary of Recommendations from the Report of The President's Water Resources Policy Commission." This publication is available from the Superintendent of Documents, Washington 25, D. C., for fifteen cents. We commend it to your attention.—R.W.W.



The edge of the sea is always changing. Like a great tide ebbing and flowing, the oceans have advanced and retreated over the continents a score of times in the long history of the earth.

COURTESY OF CHICAGO NATURAL HISTORY MUSEUM

Swift-moving marine reptiles dominated the Cretaceous seas that covered much of the northern and central part of North America. Shown in this painting by Charles R. Knight are *Platecarpus*, a "sea serpent" of those times, the large marine turtle *Archelon*, and *Pteranodon*, the largest of the flying reptiles.

The Shape of Ancient Seas

By RACHEL L. CARSON

Miss Rachel Carson is editor-in-chief of the United States Fish and Wildlife Service. She received the AAAS-George Westinghouse Science Writing Award for 1950 for her article. "The Birth of an Island," in *The Yale Review*. She is author of *Under the Sea Wind*, published in 1941. Her second book, *The Sea Around Us*, will be published by the Oxford University Press in June. This article will appear as a chapter in that book.

WE LIVE in an age of rising seas. Along all coasts of the United States a continuing rise of sea level has been perceptible on the tide gauges of the Coast and Geodetic Survey since 1930. For the thousand-mile stretch from Massachusetts to Florida, and on the coast of the Gulf of Mexico, the rise amounted to about a third of a foot between 1930 and 1948. The water is also rising — but more slowly — along Pacific shores. The records of the tide gauges do not include the transient advances and retreats of the water caused by winds and storms, but signify a steady, continuing advance of the sea upon the land.

This evidence of a rising sea is an interesting and even an exciting thing because it is rare that we, in the short span of human life, can actually observe and measure the progress of one of the great earth rhythms. What is happening is nothing new. Over the long span of geologic time, the ocean waters have come in over North America many times, and have again retreated into their basins. For the boundary between sea and land is the most fleeting and transitory feature of the earth, and the sea is forever repeating its encroachments upon the continents. It rises and falls like a great tide, sometimes engulfing half a continent in its flood, reluctant in its ebb, moving in a rhythm mysterious and infinitely deliberate.

Now once again the ocean is over-full, spilling over the rims of its basins. It fills the shallow seas that border the continents, like the Barents, Bering, and China Seas. Here and there it has advanced into the interior and lies in such inland seas as Hudson Bay, the St. Lawrence embayment, the Baltic, and Sunda Sea. On the Atlantic coast of the United States the mouths of many rivers, like the Hudson and the Susquehanna, have been drowned by the advancing flood; the old, submerged channels are hidden under bays like the Chesapeake and the Delaware.

The advance noted so clearly on the tide gauges may be part of a long rise that began thousands of years ago — perhaps when the glaciers of the most recent Ice Age began to melt. But it is only within recent decades that there have been instruments to measure it in any part of the world. Even now the gauges are few and scattered, considering the world as a whole. Because of the scarcity of world records, it is not known whether the rise observed in the United States since 1930 is being duplicated in all other continents.

Where and when the ocean will halt its present advance and begin again its slow retreat into its basin, no one can say. If the rise over the continent of North America should amount to a hundred feet (and there is more than enough water now frozen in land ice to provide such a rise) most of the Atlantic seaboard, with its cities and towns, would be submerged. The

ERAS	*Periods of geologic time — approximate millions of years ago.*	*Changing shapes of seas.*	*Important marine deposits.*	*Development of life.*	
CENOZOIC	Pleistocene 0-1	Sea level fluctuating because of repeated glaciation.		Rise of man. Modern plants and animals.	AGE OF MAMMALS
CENOZOIC	Tertiary 1-60	Great submergence of lands.	Nummultic limestone formed; later used in pyramids.	Higher mammals, except man. Highest plants.	AGE OF MAMMALS
MESOZOIC	Cretaceous 60-130	Much of Europe and about half of North America submerged.	Chalk cliffs of England formed.	Last of the dinosaurs and flying reptiles.	AGE OF REPTILES
MESOZOIC	Jurassic 130-155	Last invasion of sea into eastern California and Oregon.	Great salt beds formed in Gulf of Mexico area; now site of petroleum operations.	First birds. Reptiles dominant on sea and land.	AGE OF REPTILES
MESOZOIC	Triassic 155-185			First dinosaurs. Some reptiles return to marine life. Small, primitive mammals.	AGE OF REPTILES
PALEOZOIC	Permian 185-210	Extensive seas over western U. S. and Europe.	Largest salt beds in world formed in Germany.	Primitive reptiles. Earliest cycads and conifers. Amphibians declining.	AGE OF REPTILES
PALEOZOIC	Carboniferous 210-265	Repeated advances and retreats of sea over wide areas.	Great limestone beds in central U. S. Now used as building materials.	Great development of amphibians. Coal-making plants.	AGE OF AMPHIBIANS
PALEOZOIC	Devonian 265-320	About 40 percent of U. S. submerged.		Ages of fishes. First amphibian fossils.	AGE OF FISHES
PALEOZOIC	Silurian 320-360	Several invasions by seas; about half N. America covered.	Salt beds formed in eastern U. S.	*First life appeared on continents.*	AGE OF INVERTEBRATES
PALEOZOIC	Ordovician 360-440	Greatest known invasion of North America by seas; more than half continent covered.		Earliest known vertebrates. Cephalopods common.	AGE OF INVERTEBRATES
PALEOZOIC	Cambrian 440-520	Seas advance and withdraw, at one time covering much of U. S.		First clear fossil record dates from this period; all major groups of invertebrates established.	AGE OF INVERTEBRATES
	Pre-Cambrian 550-2100	(Evidence obscure.)		Rise of invertebrates. (inferred)	AGE OF INVERTEBRATES

surf would break against the foothills of the Appalachians. The coastal plain of the Gulf of Mexico would lie under water; the lower Mississippi Valley, submerged.

If, however, the rise should be as much as six hundred feet, large areas in the eastern half of the continent would disappear under the waters. The Appalachians would become a chain of mountainous islands. The Gulf of Mexico would creep north, finally meeting in mid-continent with the flood that had entered from the Atlantic into the Great Lakes, through the valley of the St. Lawrence. Much of northern Canada would be covered by water from the Arctic Ocean and Hudson Bay.

All this would seem to us extraordinary and catastrophic, but the truth is that North America, and most other continents, have known even more extensive invasions by the sea than the one we have just imagined. Probably the greatest submergence in the history of the earth took place in the Cretaceous Period, about 100 million years ago. Then the ocean waters advanced upon North America from the north, south, and east, finally forming an inland sea about 1000 miles wide. This extended from the Arctic to the Gulf of Mexico, and then spread eastward across southern United States to cover the coastal plain from the Gulf to New Jersey. At the height of the Cretaceous flood about half of North America was submerged. All over the world the seas rose. They covered most of the British Isles, except for scattered outcroppings of ancient rocks. In southern Europe only the old, rocky highlands stood above the sea, which intruded in long bays and gulfs, even into the central highlands of the continent. The sea moved into Africa and laid down deposits of sandstones; later weathering of these rocks provided the desert sands of the Sahara. From a drowned Sweden, an inland sea flowed across Russia, covered the Caspian Sea, and extended to the Himalayas. Parts of India were submerged, and of Australia, Japan and Siberia. On the South American continent, the area where later the Andes were to rise was covered by sea.

With variations of extent and detail, these events have

Associations of marine fossils found in areas now a thousand miles or more inland remind of ancient seas.

U.S. GEOLOGICAL SURVEY

been repeated again and again. The very ancient Ordovician seas, some 400,000,000 years ago, submerged more than half of North America, leaving only a few large islands marking the borderlands of the continent, and a scattering of smaller ones rising out of the inland sea. The marine transgressions of Devonian and Silurian time were almost as extensive. But each time the pattern of invasion was a little different, and it is doubtful that there is any part of the continent that at some time has not lain at the bottom of shallow seas.

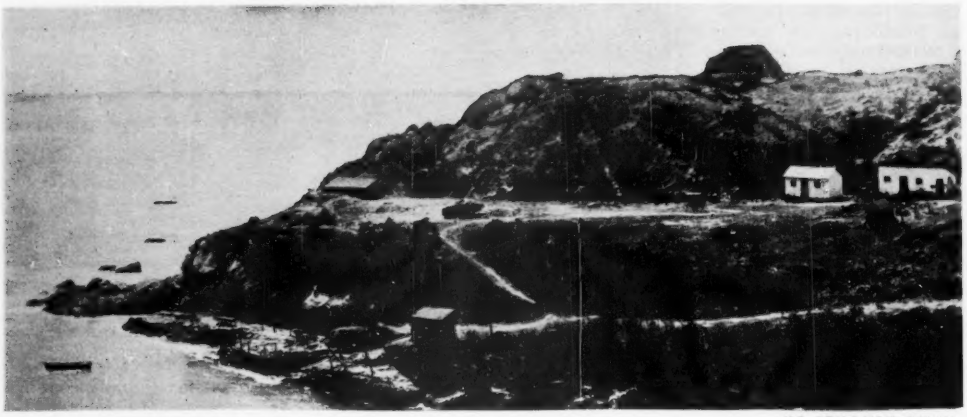
You do not have to travel to find the sea, for the traces of these ancient stands are everywhere about. Although you may be a thousand miles inland, you can easily find reminders that will reconstruct for the eye and ear of the mind the processions of its ghostly waves and the roar of its surf, far off in time. So, on a mountain top in Pennsylvania, I have sat on rocks of whitened limestone, fashioned of the shells of billions upon billions of minute sea creatures. Once they had lived and died in an arm of the ocean that overlaid this place, and their limy remains had settled to the bottom. There, after eons of time, they had become compacted into rock, the sea had receded, and after yet more eons the rock had been uplifted by bucklings of the earth's crust; now it formed the backbone of a long mountain range.

Far in the interior of the Florida Everglades I have wondered at the feeling of the sea that came to me — wondered until I realized that here were the same flatness, the same immense spaces, the same dominance of the sky and its moving, changing clouds; wondered until I remembered that the hard, rocky floor on which I stood, its flatness interrupted by upthrust masses of jagged coral rock, had been only recently constructed by the busy architects of the coral reefs under a warm sea. Now the rock is thinly covered with grass and water; but everywhere is the feeling that the land has formed only the thinnest veneer over the underlying platform of the sea, and that at any time the process might be reversed and the sea reclaim its own.

So in all lands we may sense the former presence of the sea. There are outcroppings of marine limestone in the Himalayas, at an elevation of 20,000 feet. These rocks are reminders of a warm, clear sea that lay over southern Europe and northern Africa and extended into southwestern Asia. This was some fifty million years ago. Immense numbers of large protozoans known as nummulites swarmed in this

PHOTOGRAPH BY CREN BINGHAM, KANSAS GEOLOGICAL SURVEY.

Castle Rock, eroded out of Cretaceous chalk in Cove County, Kansas. Out of this chalk have come the fossil remains of many marine creatures that once lived in the seas that lay over the central part of the North American continent.



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Mallagh Landing on the California coast tells its own story of its geologic past. Three times, in comparatively recent ages, the sea stood at a higher level long enough for its waves to cut a bench in the rock of the cliff. The uppermost bench is 100 feet above present sea level, the middle one 60 feet, the lower one 10 feet.

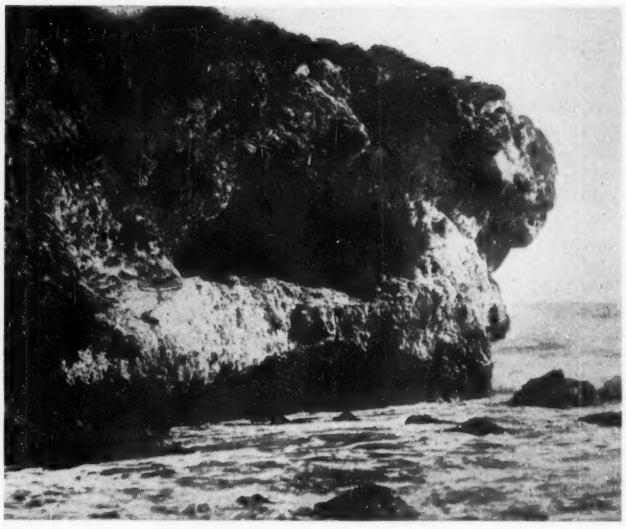
sea and each, in death, contributed to the building of a thick layer of nummulitic limestone. Eons later, the ancient Egyptians were to carve their Sphinx from a mass of this rock; other deposits of the same stone they quarried to obtain material to build their pyramids.

The famous white cliffs of Dover are composed of chalk deposited by the seas of the Cretaceous period, during that great inundation of which we have spoken. The chalk extends from Ireland through Denmark and Germany, and forms its thickest beds in south Russia. It consists of shells of minute sea creatures called Foraminifera, the shells being cemented together with a fine-textured deposit of calcium carbonate. In contrast to the foraminiferal ooze that covers large areas of ocean bottom at moderate depths, the chalk seems to be a shallow-water deposit, but it is so pure in texture that the surrounding lands must have been low deserts, from which little material was carried seaward. Grains of windborne quartz sand, which frequently occur in the chalk, support this view. At certain levels the chalk contains nodules of flint. Stone Age men mined the flint for weapons and tools, and also used this relic of the Cretaceous sea to light their fires.

Many of the natural wonders of the earth owe their existence to the fact that once the sea crept over the land, laid down its deposits of sediments, and then withdrew. There is Mammoth Cave in Kentucky, for example, where one may wander through miles of underground passages and enter rooms whose ceilings are 250 feet overhead. Caves and passageways have been dissolved by ground water out of an immense thickness of limestone, deposited by a Paleozoic sea. In the same way, the story of Niagara Falls goes back to Silurian time, when a vast embayment of the Arctic Ocean crept southward over the continent. Its waters were clear, for the borderlands were low and little sediment or silt was carried into the inland sea. So it deposited large beds of the hard rock, called dolomite. In time they formed a long escarpment at about the border between Canada and the United States. Millions of years later, floods of water released from melting glaciers were to pour over this cliff, cutting away the soft shales that underlaid the dolomite, and causing mass after mass of the undercut limestone to break away. In this fashion Niagara Falls and its gorge were created.

Some of these inland seas were immense and important features of their world, although all of them were shallow as compared with the central basin where, since earliest time, the bulk of the ocean waters have resided. Some may have been as much as 600 feet deep, about the same as the depths over the outer edge of the continental shelf. No one knows the pattern of their currents, but often they must have carried the warmth of the tropics into far northern lands, because the land masses that now obstruct or divert the currents were reduced in area. During the Cretaceous, for example, breadfruit, cinnamon, laurel, and fig trees grew in Greenland. When the continents were reduced to groups of islands there must have been few places that possessed a continental type of climate with its harsh extremes of heat and cold; mild oceanic climates must, rather, have been the rule.

Geologists say that each of the grander divisions of earth history known as eras consists of three phases — in the first the continents are high, erosion is active, and the seas are largely confined to their basins; in the second the continents are lowest and the seas have invaded them broadly; in the third the continents have begun once more to rise. According to the late Charles Schuchert, who devoted much of his distinguished career as a geologist to mapping the ancient seas and lands: "Today we are living in the beginning of a new cycle, when the continents are largest, highest,



Sea caves like this one on the California coast are eloquent testimony of changing relations of continents and oceans. The level of the sea is now ten feet lower than when this cave was wave-cut out of soft volcanic ash.

U.S. GEOLOGICAL SURVEY.

and scenically grandest. The oceans, however, have begun another invasion upon North America."

What brings the ocean out of its deep basins, where it has been contained for eons of time, to invade the lands? Probably there has always been, not one alone, but a combination of causes.

The mobility of the earth's crust is inseparably linked with the changing relations of sea and land — the warping upward or downward of that surprisingly plastic substance that forms the outer covering of our earth. The crustal movements affect both land and sea bottom, but are most marked near the continental margins. They may involve one or both shores of an ocean, one or all coasts of a continent. They proceed in a slow and mysterious cycle, any phase of which may require millions of years for its completion. Each downward movement of the continental crust is accompanied by a slow flooding of the land by the sea, each upward buckling by the retreat of the water.

But the movements of the earth's crust are not alone responsible for the invading seas. There are other important causes. Certainly one of them is the displacement of ocean water by land sediments. Every grain of sand or silt carried out by the rivers and deposited at sea displaces a corresponding amount of water. Disintegration of the land and the seaward freighting of its substance have gone on since the beginning of geologic time, without interruption. It might be thought that the sea level would have been rising continuously, but the matter is not so simple. As they lose substance the continents tend to rise higher, like a ship relieved of part of its cargo. The ocean floor, to which the sediments are transferred, sags under its load. The exact combination of all these conditions that will result in a rising ocean level is a complex matter, not easily recognized or predicted.

Then there is the growth of the great submarine volcanoes, which build up immense lava cones on the floor of the ocean. Some geologists believe these may have an important effect on the changing level of the sea. The bulk of some of these volcanoes is impressive. Bermuda is one of the smallest, but its volume beneath the surface is about 2500 cubic miles. The Hawaiian chain of volcanic islands extends for nearly 2000 miles across the Pacific and contains several islands of great size; its total displacement of water must be tremendous. Perhaps it is more than coincidence that this chain arose in Cretaceous time, when the greatest flood the world has ever seen advanced upon the continents.

For the past million years, all other causes of marine transgressions have been dwarfed by the dominating role of the glaciers. The Pleistocene period was marked by alternating advances and retreats of a great ice sheet. Four times the ice caps formed and grew deep over the land, pressing southward into the valleys and over the plains. And four times the ice melted and shrank and withdrew from the lands it had covered. We live now in the last stages of this fourth withdrawal. About half the ice formed in the last Pleistocene glaciation remains in the ice caps of Greenland and Antarctica and the scattered glaciers of certain mountains.

Each time the ice sheet thickened and expanded with the unmelted snows of winter after winter, its growth meant a corresponding lowering of the ocean level. For, directly or indirectly, the moisture that falls on the earth's surface as rain or snow has been withdrawn from the reservoir of the sea. Ordinarily, the withdrawal is a temporary one, the water being returned via normal run-off of rain and melting snow. But in the glacial period the summers were cool, and the snows of the preceding winter did not melt entirely, but were carried over for another winter, when the new snows should find and cover them. So, little by little, the level of the sea dropped as the glaciers robbed it of its water, and, at the climax of each of the major glaciations, the ocean all over the world stood at a very low level.

Today, if you will look in the right places, you will see the evidences of some of these old stands of the sea. Of course the strand marks left by the extreme low levels are now covered deeply by water, and are to be

made out only indirectly by sounding. But where, in past ages, the water level stood higher than it does today, you can find its traces. In Samoa you can find benches cut in the rocks by waves, at the foot of a cliff wall now fifteen feet above the present level of the sea. You will find the same thing on other Pacific islands, and on St. Helena in the south Atlantic, on islands of the Indian Ocean, in the West Indies, and around the Cape of Good Hope.

Sea caves in cliffs now high above the battering assault and the flung spray of the waves that cut them are eloquent of the changed relation of sea and land. You will find such caves scattered over the world. On the west coast of Norway there is a remarkable, wave-cut tunnel. Out of the hard granite of the island of Torghatten, the pounding surf of a flooding interglacial sea cut a passageway through the island, a distance of about 530 feet, and in so doing removed nearly five million cubic feet of rock. The tunnel now stands 400 feet above the sea, in part because of the elastic, upward rebound of the crust after the melting of the glacial ice.

In the other half of the cycle, when the seas sank lower and lower as the glaciers grew in thickness, the world's shorelines were undergoing changes even more far-reaching and dramatic. Every river felt the effect of the lowering sea; its waters were speeded in their course to the ocean and given new strength for the deepening and cutting of their channels. Following the downward-moving shorelines, they extended their courses over the drying sands and muds of what only recently had been the sloping sea bottom. Here the rushing torrents of the rivers — swollen with the melting glacier water — picked up great quantities of the loose mud and sand and rolled into the sea as a turgid flood.

During one or more of the Pleistocene lowerings of sea level, the floor of the North Sea was drained of its water and for a time became dry land. The rivers of northern Europe and of the British Isles followed the retreating waters seaward. Eventually the Rhine captured the whole drainage system of the Thames. The Elbe and the Weser became one river. The Seine rolled through what is now the English Channel and cut itself a trough out across the continental shelf — perhaps the same drowned channel now discoverable by soundings beyond Lands End.

The greatest of all Pleistocene glaciations came rather late in the period — probably only about 200 thousand years ago, and at a time well within the history of man. The tremendous lowering of sea level must have affected the life of Paleolithic man. Certainly he was able, at more than one period in history, to walk across a wide bridge at Bering Strait, which became dry land when the level of the ocean dropped below this shallow shelf. There were other land bridges, created in the same way. As the ocean receded from the coast of India, a long submarine bank became a shoal, then finally emerged, and primitive man walked across "Adam's Bridge" to the Island of Ceylon.

Many of the settlements of ancient man must have been located on the sea coast, or near the great deltas of the rivers, and relics of his civilization may lie in caves long since covered by the rising ocean. Our meager knowledge of Paleolithic man might be increased by searching along these old, drowned shorelines. One archeologist has recommended searching shallow portions of the Adriatic Sea, with "submarine boats casting strong electric lights," or even with glass-bottomed boats and artificial light, in the hope of discovering the outlines of shell-heaps — the kitchen middens of the early men who once lived here. Professor R. A. Daly has pointed out that "The last Glacial stage was the Reindeer Age of French history. Men then lived in the famous caves overlooking the channels of the French rivers, and hunted the reindeer which throve on the cool plains of France south of the ice border. The Late-Glacial rise of general sea-level was necessarily accompanied by a rise of the river waters downstream. Hence the lowest caves are likely to have been partly or wholly drowned. . . . There the search for more relics of Paleolithic man should be pursued."

Some of our Stone Age ancestors must have known directly the rigors of life near the glaciers. While men as well as plants and animals moved southward before the ice, some must have remained within sight and sound of the great frozen wall. To these the world was a place of storm and blizzard, with bitter winds roaring down out of the blue mountain of ice that dominated the horizon and reached upward into gray skies, all filled with the roaring tumult of the advancing glacier, and with the thunder of moving tons of ice breaking away and plunging into the sea.

But those who lived half the earth away, on some sunny coast of the Indian Ocean, walked and hunted on dry land over which the sea, only recently, had rolled deeply. These men knew nothing of the distant glaciers, nor did they understand that they walked and hunted where they did because quantities of ocean water were locked up in those polar mountains of ice.

In any imaginative reconstruction of the world of the Ice Age we are plagued by one tantalizing uncertainty — how low did the ocean level fall during the period of greatest spread of the glaciers, when unknown quantities of water were locked up in the ice? Was it only a moderate fall of two or three hundred feet — a change paralleled many times in geologic history in the ebb and flow of the epicontinental seas? Or was it a dramatic drawing down of the ocean by two thousand, even three thousand feet?

Each of these various levels has been suggested as an actual possibility by one or more geologists. Perhaps it is not surprising that there should be such radical disagreement. It is only about a century since Louis Agassiz gave the world its first understanding of the moving mountains of ice and their dominating effect on the Pleistocene world. Since then, men in all parts of the earth have been patiently accumulating the facts, reconstructing the events of those four successive advances and retreats of the ice. (Continued on page 272)

The little brook is the heart of the sanctuary, where water thrushes nest and birds come to drink all summer long. Mrs. Smith, owner of Seven Acres, smiles through a misty rain.

Six Years at Seven Acres

By PAUL H. FLUCK

Six years ago, Seven Acres was just seven acres of orchard, truck patch and lawn. Today these seven acres are known to bird lovers for miles around. For Seven Acres has become a bird sanctuary.

Six years ago, I saw Seven Acres for the first time. I saw it because a rose-breasted grosbeak saw it first. He stopped, puffed out his magnificent scarlet breast, and hopped lower in the enormous poplar tree. Then, with a flip of his black and white wings, he whisked himself out of my range of vision. I did not see another rose-breasted grosbeak there for three years. By then, Seven Acres was a real bird sanctuary.

As I trespassed, that first day, my eyes fell first on a thriving clump of forsythia, the biggest tangle of forsythia I have ever seen. In and out among the yellow bells flipped catbirds, brown thrashers, song sparrows, house wrens; from the deepest tangle I heard the cheerful song of an early warbler. That forsythia was a bird sanctuary of its own, I have never forgotten it. Today, it is wilder, more tangled than ever. It is the very heart and soul of Seven Acres.

Then I saw the pleasant mistress of Seven Acres. She was stooping over tying up a young shrub, tenderly, as if she was straightening out some little urchin, slumped over like his favorite comic character. I walked over to her and introduced myself. There and then, I began to help this lady, who was to be my hostess for several years, to make her dream come true; to make a bird sanctuary at Seven Acres.

Recently, when I crossed the little stone bridge spanning the brook, a man and a woman stood looking into the trees with binoculars. Just a little way down the road a car was parked. From it, an invalid, who comes almost every day to see the birds at Seven Acres, scanned the trees with a pair of opera glasses. In the orchard, the garden, or in the little woodlot, which is home for more than thirty-five species of nesting birds, I have met men and women from Long Island, Washington, and Maryland; from Missouri, Connecticut, Indiana, and a dozen other states. They will cluster around me while I point out our non-taxpaying residents. And they have all gone away impressed; always jealously wanting a bird sanctuary of their own — like Seven Acres.

It is infinitely easier, and a lot more fun, to develop a bird sanctuary than a rock garden, or to raise prize-winning roses. The Japanese beetles may arrive and gobble your roses up. But at Seven Acres the birds arrive and gobble up the Japanese beetles.

We did not just ring a bell to call the birds in. We invited them in, one by one, by putting out a special kind of food, by providing attractive quarters, and by giving others the privacy their retiring natures demanded. But one by one, we have added more birds to our list, until now the only small New Jersey birds that we do not have at Seven Acres are those that are too weak to fight their way in.

We started our sanctuary by doing the easiest chore a gardener ever has to do. We allowed the weeds to grow. We allowed the vines to grow. We allowed the rambling roses to grow. And for six years they have grown. Maybe they would have looked prettier if they had been clipped back. But they could not possibly have offered such complete living comfort to so

Yellow-bellied sapsuckers have peppered the trunk of this crab apple with a machine-like regularity, but the tree is one of the healthiest in the sanctuary. At the base of the tree is a bird-banding trap.

many baby song sparrows, or to so many shivering juncos and white-throated sparrows in the bitter winter months. No, those rambling roses are prettier when they are full of birds than when they are full of rambling roses. My host and hostess think so, anyhow.

Weeds! Certainly we have lots of weeds at Seven Acres. For two years I carried every pokeberry I could lay my hands on to the sunny slopes behind the house. Now, my host and hostess can watch a thousand robins alight to lunch on those luscious pokeberries in the midst of their migration flight south. A migrating robin has not much time to dig for worms, and is glad to eat berries.

With the robins come the cedar waxwings. Sometimes hundreds of those lovely brown birds sit on the limbs of the dead cherry trees, gathering the tiny grapes that grow in such thick vines. Those tiny grapes are smaller than peas, and bitter too, but if they were destroyed, we might never see our waxwings again.

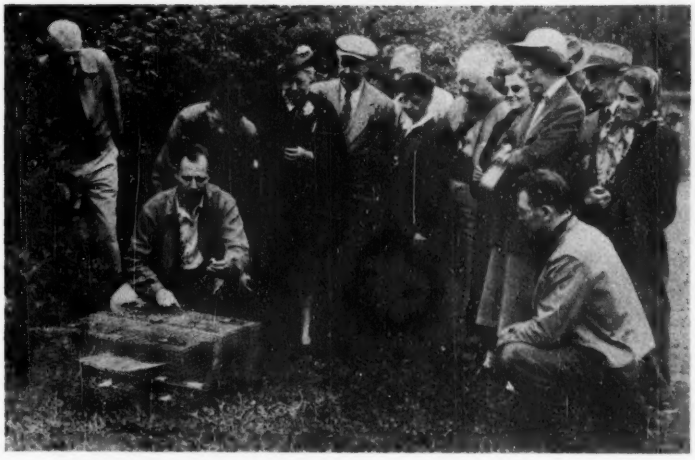
The two bird watchers who stood in the orchard the other day were looking at a golden-crowned kinglet. These little mites come and go, spring and fall. The lady at Seven Acres, of course, could have decided to raise her own apples and to call in sprayers with their arsenate of lead, or their DDT. But my host decided long ago that it was cheaper to buy his apples than to pay the overhead that caring for those apples would cost. Last year, however, there were enough birds to keep the insect population down. This year, with the help of the birds, my host and hostess are going to have lots of apple pies made from their own apples, and they will not have to pay out a dime to the spraying gang.

Most of the work on the apple trees is being done in the appleless season by nuthatches, downy woodpeckers, and tiny brown creepers. These hardworking little fellows like old and rotting trees for their homes. So, instead of tearing down every dead limb, we let these alone as long as there is no risk of their falling on the house or the barn. Before long, that limb will have a family of nuthatches, crested flycatchers, or a downy woodpecker drilling a home in the softest spot he can find. And a pair of flickers have moved into one limb that my host left on a maple tree. Nowadays, the ants at Seven Acres are not walking off with the groceries.

One tree that you would spot the minute you got out of your car in the driveway of the sanctuary is a massive crab apple tree. Few bigger crab apple trees live in New Jersey. In its old age it is still decked out like a youngster with dark apple-green leaves. Look closely and you will see that that apple tree is the sickest tree on the place. There are at least ten thousand tiny holes drilled by that "villain" of all woodpeckers, the yellow-bellied sapsucker. For years, my host and hostess have waited for this superb tree to die. For years it has amazed them with its health and vigor. Yet, those holes peppered the tree. Maybe, after all, the yellow-bellied sapsucker has not harmed the tree. Of course, some day it will die. Then folks can say that a sapsucker killed it.

The part of Seven Acres that I like best is the part that few ever see. At the top of the steep hillside, steep enough to make you pant and wheeze, is a flat patch that, no one can doubt, was once a garden. Now it is overgrown with wild grass, weeds, and blackberries. Underneath lie the remains of an old strawberry patch. It is in this weed patch and the hedgerows that surround it that my favorite birds nest and sing. Vesper sparrows, Lincoln sparrows, grasshopper sparrows, and the tiny little field sparrows with their lonesome voices come back year after year.

The secret of the sanctuary, the key to the large numbers of birds that have come to dwell there, is the flowing brook, which marks the boundary of the front yard. Along that brook, where water thrushes nest, almost every bird in the sanctuary comes at least once every two hours on a hot summer day. I am too lazy to walk around to see our birds at such times. I just sprawl comfortably in my automobile. I keep a tight



The author holds a cowbird, a bird-banding return. The bird, banded two years before beside this same forsythia bush, came back again to the trap.

grip on my binoculars and I watch those shrubs at the brookside. All day long birds come there to drink and to bathe in the quiet shallows under the drooping forsythia branches.

For two years I wondered why I never saw a chickadee coming down to drink in the hot summer weather. Then, I discovered the chickadee's secret drinking fountain. High up in an apple tree there were two little water holes not much bigger than thimbles. Here, without flying more than a few feet, the titmice and chickadees quench their thirst. And it is there that I take visitors to watch them. Even in the wintertime, through some miracle known only to Nature, the water in those holes rarely freezes.

So make your own sanctuary. It is the easiest thing you can do. Your garden will make itself into a sanctuary if you are too lazy to interfere. Every now and then, in an ambitious moment, I apprehend my host or hostess scraping the remains of a brushpile into a heap. Then they will lug some kerosene out to burn it. Certainly, in a few minutes, the unsightly thing would be gone! But so would the housing unit for the sweetest singing song sparrows in this part of the world. No, we can use that brush pile, so we keep it.

Just for fun, next year, let the weeds grow. Plant a little garden, and some flowers here and there, like my hostess does. But in the corners, in the orchards, and in the vine-covered woodlot, let Nature do the gardening. Ten chances to one she will amaze you. And when, some morning, you awaken to a new song, and you rise to see the flaming breast of a rose-breasted grosbeak at your window, or the dazzling brilliance of a scarlet tanager whisk by, you will agree that pretty things *do* grow in the hospitality of uncared-for gardens.

Save the Fire Pinks

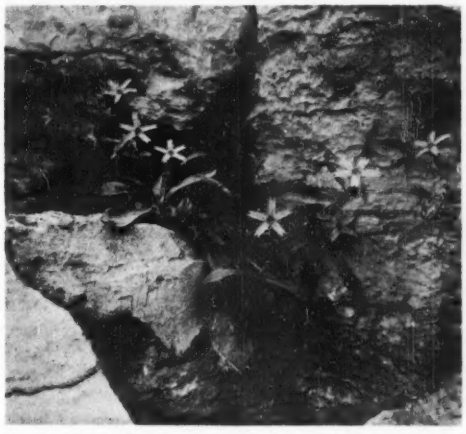
By EDWIN F. STEFFEK

INTENSE scarlet flowers, on small fountain-like plants, identify the striking but not common fire pink. In fact, it is its notable coloring that is its undoing, for few who see it can resist picking it. Yet, it can be saved by *positive* conservation. As is the case with many wild flowers, this means propagation.

As with most plants, one must first know the plant and its needs. The fire pink, *Silene virginica*, is not too fussy about soil. In some areas it definitely seems to prefer limestone outcrops, while in others it appears happy enough under mildly acid conditions. In either case, however, it prefers a gritty, well-drained soil. In the Northeast it does well in open, rather dry soils, while farther south it is found in open woods.

The fire pink is a perennial plant, and the dainty, flame-colored blooms appearing from June to August, according to location. They are tubular and deeply cleft, like split-petalled stars. The rest of the plant is small and not impressive, the stem being slender, erect and hairy, and the leaves narrow.

The fire pink is best multiplied by means of seed,



sown in late fall or very early spring. The best place is in open-ground seed beds, or in pots plunged up to their rims in soil outdoors all winter. When the seedlings are large enough to handle, transplant carefully into florist flats or individual pots until they are strong enough to set out in permanent locations.

May in A North Ohio Marsh

By RICHARD STUART PHILLIPS

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Raccoons feed in the muck of the marsh, where they seek crayfish, and climb nimbly into the trees.

FOR much of the human race, May has always been a magic time of year. To primitive man it was the time to issue forth from damp and drafty caves; to escape from dark confinement and scant rations into a sunlit world of abundant food, easily come by; to enjoy warm days and comfortable nights; a time of flowering, of new aromas, of the redolence of the blossoming and fruiting earth. To the Nature enthusiast in northern climes January is a time when the fluid essence of life flows sluggishly. August and September are months of sober maturity and fulfillment. But May is a month even to stir the blood of the cold, phlegmatic toad.

Removed as he is from contemporary forms of life by ten thousand generations of development, man yet dimly feels inexplicable compulsions during May. Perhaps you may encounter a staid businessman, a pillar of society and well known for his sound common sense, out for a midnight stroll in a pouring rain, striding briskly along as the water cascades from his hat brim and courses down his face in cool rivulets. Children may be found rolling, puppy-like, on the lawn in an outburst of animalness, or gazing steadfastly, as if enchanted, into the glowing depths of a blossoming apple tree. You may see your neighbor halt in the task of turning the rich warm earth of his garden and stand for minutes, head raised, sniffing some half-perceived message carried by the soft air. Or you may see a grandmother, with the wise, calm eyes of age, come outdoors and stand looking upward at the parade of cottony clouds moving out of the west and across the smiling sky. May is also a time to loiter in the heart of a marsh to see the life of a new year. In May we feel our darkling past; our akinness to the cold toad, the glabrous fish, and the furred mammal.

A blind man, if he were familiar with the countryside, and retained his senses of hearing and smell, would know when May comes to our northern Ohio marsh. During the last few days of April, male American toads begin to appear in the ponds, and do a bit of preparatory trilling. The first week of May sees the females, their bodies greatly distended with unshed eggs, reach the marsh from places of hibernation. From every direction they come hopping and crawling. As surely as iron is drawn to the lodestone so are they brought to the water, but by different forces — by the warmth of earth, the call of the males, and an age-old hunger to mate and be rid of their gelatinous spawn.

There is always a surplus of males. sometimes four or five warty little fellows — and runty, too, compared to the females — will be in attendance on one matronly creature. They follow her along the muddy banks and swim around her if she takes to the water, moving about like fussy little tugs shepherding an ocean-going liner out to sea. The males do most of their singing after dark, and there is nothing quite so stirring as this amphibian chorus, composed of hundreds of individual songs, each bird-like in quality, and borne on a warm, moist, May night wind.

Another certain sign of the arrival of the strange admixture of warm earth odor, mating, and new life that we know as Mayness is the song of the Baltimore oriole. Some years these birds come a little later, but often they make their appearance on the first day of the month. Occasionally, half a dozen of the burnished males arrive together in the apple orchard, whose trees are crowded together on the high ground just beyond the southwestern margin of the marsh. The first proof of their arrival may be an arc of living orange flame leaping from one treetop to another. More often it is the ringing, whistled call of the birds, and, although they may sing from the swaying boughs of an apple tree, the song is, undeniably, "pear tree, green pear tree, green-green pear tree."

A third sign of May is not really a sign, in the strict sense of the word. It is a scent — subtle, but tangible and all-pervading —, a rich infusion compounded of many things. From the farms to the south of the marsh the warm wind brings the odor of blossoming pear and apple, peach and cherry. Nearer at hand arises the scent of the hay field, and the heat of the sun draws from the water itself a redolence blended from all the teeming, diffuse, microscopic life within its depths.

The appearance of the marsh is altered, too, but it is not a subtle change. Almost overnight, leaves burgeon from the naked limbs of trees, until once more the marsh is clothed in a green mantle. Arrow-shaped

leaves of sagittaria poke above the surface, and green spears of rushes point skyward out of the shallows. In many places the untilled uplands creep cautiously down to the edge of the marsh and these tracts of wasteland support thousands of hawthorns. During the first half of May, these diminutive trees, colonizers of tired and inhospitable fields, are a riot of bloom, almost completely circling the marsh with pure but fugitive white.

Several currents of migrating birds have poured into the marsh from the south. Some of the first arrivals have passed on to their breeding grounds in the North; others remain for the nesting season. Robins, doves and song sparrows stake nesting claims among the willows and along the shrubby banks. Two nests of bluebirds are found in hollow fence posts near the sheep pasture.

Already, a brood of four speckle-breasted young robins have deserted their nests and are perched in the top of a sandbar willow, calling anxiously, almost constantly, for their parents. Brownheaded female cowbirds skulk silently and singly through the undergrowth, investigating every covert for nests in which to deposit their eggs. The male cowbirds gather in small flocks of four or five and forage along the banks, or cling to the swaying branches of shrubs and utter their grating calls. Almost perfectly hidden beneath a low-growing arborvita, a hen pheasant broods her clutch of twenty eggs. Down in the heart of a hawthorn a bright-eyed yellow warbler sits unmoving on her nest, while above her, and around her, the male flits through the warm and blossoming trees on his endless round of song.

From dawn until dusk great blue herons stand motionless in the shallows, or patiently stalk the weedy margins of the ponds, searching for insects, minnows, tadpoles, crayfish, frogs—anything edible to help satisfy the voracious appetities of their clamorous young. East of the marsh, in Weyer's woods, is the heronry. There are upwards of thirty nests and nine of these are among the dead branches of the old lightning-blasted elm. On heavy wings the herons shuttle back and forth between the marsh and the woods in an almost endless procession, carrying sustenance to the young as though on a living conveyor belt. The young stand on the edges of the nests and, when the wind is right, their throaty croaks and hoarse screams can be heard distinctly over the marsh.

Those species of birds of the first wave of migration that are not nesting are preparing to. A male pied-billed grebe is using most of the big pond to display his charms to a demure female. To him this is a serious business. He rushes the length of the pond, half-running, half-flying. His feet churn the surface of the water into a tawny froth and his wings beat the air frantically. When he reaches the unresponsive female he circles at great speed, tossing water like a turning speedboat. Then he subsides, edges up beside her and talks to her in low cooing notes. Receiving no answer he paddles away, the water boiling furiously in his wake.

PHOTOGRAPH BY ALLAN D. CRUICKSHANK
FROM NATIONAL AUDUBON SOCIETY

May sees the trees now swarming with migrating warblers; now almost bare of any bird life. Here a yellow warbler sits in the nest. Other warbler visitors or residents are blue-backed Canadas, Cape Mays, redstarts and others of this busy and brightly colored clan.

On a dead branch of the old sycamore three downy young screech owls sit, staring into the gloom and snapping their beaks at every strange noise.

Then, as if despairing of ever winning the coy hen and deciding to end it all, he comes to a halt, head bowed disconsolately, and slowly sinks below the surface like a storm-battered schooner, its hull broken open. Seconds later he surfaces directly in front of his intended, so violently and in such a flurry of spray that even her imperturbable calm is ruffled. She swims haughtily away — if a pied-billed grebe can swim haughtily — and he follows, his body completely submerged and just the tip of his bill showing above the surface, periscope-like. Popping out of the water like a suddenly released cork, the ardent swain skates across the surface and reaches the hen in a surge of wavelets of his own making. Stretching to his full height before her, he beats the air with widespread wings, while she, unimpressed, quietly picks up a bit of floating weed and offers it to him. Disgusted with this show of inanity, he paddles into a reedy tangle to sulk, but in a few minutes he will be back with an entirely new repertoire of tricks, quite undaunted.

The last great wave of migration passes through the marsh in May. Many of these migrants follow the courses of streams in their northward movement, and the creek that enters the marsh from the southwest funnels thousands of them into the area. The ponds are the only sizable bodies of water within several miles, and this, too, tends to concentrate the water and shorebirds in the marsh.

Every year, early in May, one or two ospreys cross the marsh at a considerable height. They seem to look down disdainfully at the small ponds and the shallow water, for never yet has one seen fit to hesitate in flight or circle about, the better to inspect the area. There is no concentration of rose-breasted grosbeaks in the marsh because of the dearth of tall trees, but each May sees a few of these beautiful birds, with their black tail-coats and rosy bibs, tucked in at the neck, pause in the one large sycamore that stands in the center of the marsh. There they tear at the round, brown seed balls that have clung to the tree since the previous summer, and utter their sweet, robin-like notes.

At times during the month the shrubby willows that are legion in the marsh are almost bare of small birds; at other times these same trees swarm with migrating warblers. Often there are twenty or more tiny, brightly colored birds of four or five species in one small tree. Trim, blue-backed Canada warblers perch quietly in the trees, their black necklaces startlingly clear against the yellow of their breasts. Male redstarts hop among the twigs with drooping wings and wide-spread tails, or dash into the golden sunlight, to be glimpsed momentarily, their orange, flame-colored plumage like burning jewels mounted on a coal-black matrix. Cape May warblers, with their distinctive chestnut ear patches, move along the slender twigs like tight-rope walkers, fluttering their wings to preserve their balance. They crane their necks to snatch at flying gnats, then retrace their steps to take a droning midge at the other end of the twig.

Toward evening cleft-tailed barn swallows, with glowing breasts and throats, flock into the marsh and sweep back and forth across the ponds, occasionally dipping down to the surface for a sip of cool water. Bats whirl overhead, winnowing the air of its insect chaff, while barn owls, lost in the purple dome of deep dusk, cross the marsh, screaming rustily, headed for the uplands and the haunts of the meadow voles.

Baby rabbits, free at last of the warm confinement of the downy birth chamber, but seeming too small to be unattended, frolic through the tall, sweet grasses of the dikes. On a dead branch of the old sycamore three downy young screech owls sit, staring into the gloom and snapping their beaks at every strange noise. Down close to the dark water four baby raccoons, chirring happily and excitedly to themselves, their mother, and the May dusk, follow the old one on their first outing. For the first time they patter through the odorous mud that carries strange but half-familiar scents. One, fumbling through the bottom muck with sensitive fingers, traps a crayfish against a rock and learns the joy of crunching the brittle shell. Another, in swift imitation of its mother, leaps upon a frog and feels the cold, anguished squirming in its hands. The most venturesome of the litter scrambles clumsily into a wild black cherry tree and chirrs (Continued on page 274)

Without doubt the bears of Yellowstone National Park have been seen, fed and photographed by more people than those anywhere outside of a zoo. Indeed, they became a serious problem, and the public is now urged to observe the bears at a respectful and safe distance. Park regulations prohibit molesting, teasing or feeding them. Through the years, however, many "characters" have been known among the bears of the Yellowstone. In this article Mr. Wylie, a former Yellowstone ranger, tells of some of these notable individuals of his own acquaintance.

Bear Individualists of Yellowstone Park

By ROBERT H. WYLIE
as told to
THOMAS H. McKEE

One night, in bed in ranger quarters, I was awakened by what seemed to be the weight of the world bearing down on me. My breath was being squeezed from my lungs and my bones felt as though about to crack. In the pitchy darkness I tried to yell for help, but could make no sound. My arms were free, however, and I tried to grapple with some huge, shaggy thing, the bulk of which was too much for my strength. I felt the puff of warm air on my face and the drip of a tepid fluid on my neck. Words cannot describe my terror.

The mental and physical agony seemed ages long. I thought I was dying, and, perhaps, I was. Suddenly the weight shifted and breath came into my starving lungs. I let out a yell at last, bringing fellow rangers. At that moment a big but agile creature departed through the open window by my bed, into the darkness outside. Because of an event the day before we knew who my visitor had been.

Near the Canyon Village was a garbage cistern, the odors of which attracted all the bears of that community. It was built to be bear-proof, having a roof of concrete with a man-hole covered by a cast-iron lid. Although this lid weighed more than a hundred pounds and fitted into its groove so closely that workmen had to use a thin-edged metal tool to remove it, some of the older bears learned that, with patience, a claw could occasionally be inserted far enough to lift the plate from its seat. With the man-hole open, a bear could insert head and front quarters through the opening, and, supported only by haunches outspread upon the rim, fish for edible dainties. The day before my bear "nightmare" I had been called to the cistern. During the previous night some bear had succeeded in taking off the man-hole cover, and now, beside the opening and peering anxiously into it, sat Rachel, a mother bear of distinction in our colony. She panted violently. Her red tongue lolled out and her huge body swayed to and fro as with extreme weariness.

Let a bear cub appear on the scene and the scenic wonders of the Park are forgotten.

Rachel was the mother of two fine cubs, now well along in the second summer of their lives and weighing about three hundred and fifty pounds each. In spite of their age and size Rachel continued to lavish affection upon them. She guarded them, taught them, bossed them all day long, seldom allowing them out of her sight. She would fight for them, no matter the size or pugilistic reputation of a bear adversary.

Rachel's attention was centered on something down

Grizzly bears are less dependent on human sources of food than the black bears, but even the big fellows like handouts, as here when they feed with seagull company.

in the cistern. A bit rested, she plunged her front quarters down through the opening, which was less than two feet in diameter. Supported by her spreading haunches, she caught the object below in claws and teeth and slowly began to lift. Her mighty muscles strained, and, little by little, her body emerged. When her head appeared I saw, gripped in her teeth and supported by her paws, a part of one of her own beloved cubs.

Rachel's fiercest struggling failed. The big cub, cross-wise of the hole, would not pass the rim. Slowly, the cub's weight drew the parent down; the strength of her jaws failed, and the cub slipped back into the deep water below. Rachel lay beside the hole, gazing into it, moaning, the young one swimming about again and uttering gurgling cries of distress. Finally she tried again, and then again. I stood by hoping that at last she would get hold of the cub by head or rump and so bring it through the hole endwise. But this hope faded as her efforts continued and her exhaustion increased.

Rachel was so far gone, at last, that she could not fight us. So we drove her back, although she retreated most unwillingly. Stationing one man to guard us and to give warning in case of a charge, we quickly threw a lasso about the cub's neck and hauled him forth, head first, with no more difficulty than the heavy lift.

Young bears are imitative. Rachel's cub had seen an older bear lower itself into the cistern and come up with good things to eat. Because his body was too short to reach the surface of the water, or because his thighs were too narrow to take firm hold on the hole's rim, the cub's attempt had proved disastrous.

Between his lengthy immersion and the choking effect of the rope, the cub landed on top, sprawling and senseless. We thought him dead. But then began one of the strangest performances that even we "Bear-Wranglers" had ever seen.

At sight of her rescued cub, Rachel came at us with a rush that sent us scurrying. Then she turned her attention to the inanimate young one. She knew exactly what to do. Seizing him with her paws she rolled him about, slapped him and thumped him until we felt that if he were not dead already he soon would be. But soon the water he had swallowed began to pour from his mouth and he kicked a little. His parent's efforts redoubled. In ten minutes the patient was sitting up; then staggering about, woozy in his wits but plainly recovering. But the mother's drubbing did not cease. In fact, the treatment was so rough that we thought of intervening, and would have done so had Rachel's state of mind been less ferocious.

All this occurred within a few rods of the rim of Yellowstone Canyon, where the descent is about four hundred feet, much of it sheer precipice. As the belabored cub's senses began to function again, he retreated toward the canyon wall. Suddenly he darted blindly away and plunged over the cliff, in spite of Rachel's rush to grab him. Down he went, the full four hundred feet, landing near the river below, still alive but badly hurt. For a moment Rachel acted as if she would go right on over after him, but changed her mind and set out to find a safer way down.

Three of us rangers went down, too, prepared to destroy the wounded bear should we find his injuries too serious for recovery. They were and we had to shoot him. Rachel had not yet arrived but was enroute. The dead cub lay on a narrow ledge and had to be skinned and disposed of, and we did not relish the prospect of encountering the bereft parent on such scanty footing. We decided to carry the body up, keeping to ground that would permit escape if Rachel appeared and offered battle.

With the heavy cub to lug, our climb was laborious and slow, and Rachel met us half way up. She had failed to reach the bottom by the route she had attempted; had gone back and tried again. Curiously enough, her attitude was mild. She could have put us to flight at any moment she wished, but did not. I felt she remembered our friendly act in pulling the cub from the cistern, and now felt sure we were doing her baby another good turn in fetching it up. Of course

A bear family scene. Dad is panting, and, judging from a sheepish look of the cub, has just delivered an emphatic parental rebuke.

she did not know the cub was dead. In fact, bears do not seem to comprehend death and its finality, especially that of their own kind.

Seeing us deposit the body in a shed in our camp, Rachel wandered peaceably away. She had a surviving youngster to search for, and her big body must have been sorely in need of rest after all her terrific exertions.

I skinned the cub, buried the carcass, washed up and turned in. Prowling about, looking for her lost child, Rachel had come to my open window. The cub's scent, despite all my washing, reached the mother's keen nostrils. Entering, she had sat on me while she sniffed me all over, giving me the fright of my life.

One morning soon after, Rachel was again found at the cistern, vainly trying to extricate her other cub. This time she made way for us rather readily, seeming to know that we might again succeed better than she. But we were too late this time. The victim came out senseless, and all the mother's efforts at resuscitation failed. For hours she rolled and pummeled the body, to no purpose. The cub was dead, and Rachel was childless.

A complete change now came upon Rachel. No longer the proud and combative mother of yore, she wandered aimlessly about, uttering a gentle, plaintive little whine, ever on the hunt for her lost ones. The neighborhood of the fatal cistern became a regular haunt. She traveled up and down, up and down, day after day, over the route up which we had carried the dead cub from the river's brink, moaning her soft little cry and sniffing the rocks and bushes against which the body had rubbed.

Rachel became so emaciated, and her steps so slow, that we felt sure she could never survive the oncoming winter. She was not accumulating the thick layers of fat necessary to successful hibernation. Apparently the blighting of her mother-love had dulled the natural instinct that leads her tribe to feed heavily in autumn, in preparation for the long winter sleep. Then, after losing sight of her for a few days, I was called to look at a queer object lying at the foot of the cliff down which the cub had fallen. Rachel was stretched out, dead, on the very spot where the cub's life had ended.

The body was perfectly preserved by autumn frost. and, aside from its extreme gauntness, showed no sign of injury or disease. All the witnesses to this series of events, and they are numerous, believe that Rachel died of a broken heart.

Another bear experience came when I chanced upon three little grizzly cubs at play on the margin of a small lake. Wholly unconscious of my presence, they frolicked about like hilarious boys, sometimes in the water, sometimes out, inventing jokes on each other and cutting up high-jinks generally. One would sneak up behind another, push him into the lake and then scamper to avoid the well-aimed splashes sent at him by the victim. All would be swimming when, at some signal, two would dive under the third, heaving him heels up and head down. Then would come a wrestling match on shore, some boxing, a chase in which one fleeing from another would be pounced upon by the third lying in wait behind a tree. Knocking a pine cone about and struggling for its possession gave lively diversion, even leading to baby fights in which one, being roughly handled, would scoot up a tree.

In such play the young bear learns to fight the body-to-body combats of his kind. In maturity each will live a solitary life, every other bear about him being an active competitor for food. Hence, fighting is an important accomplishment. At three years of age the friendships of infancy usually cease. In a community of bears each one knows, or soon learns, which of the neighbors it can whip and to which it must bow.

A whole-hearted battle between two adults, especially if they are grizzlies, is a scene not soon forgotten. With bellowing growls they rear before each other, striking blows that can be heard hundreds of yards away; they lock together in (Continued on page 274)

It hardly seems to make sense to find marine barnacles formed on a branch of sagebrush at Salton Sea in southern California, but there they are, and thereby hangs a tale.

Barnacles on the Sage

By NELL MURBARGER

Photograph by the Author

MANY anomalies are presented by the American Southwest. Springs of boiling water gush from the earth alongside ice cold streams; geysers spout from the dry-as-dust desert, and the miracle of rain transforms barren alkali flats into some of the world's most luxuriant flower gardens.

One of the most unusual paradoxes is to be found in a desert-surrounded Salton Lake of southern California, where every scrap of sagebrush or mesquite that chances to reach the water, soon is encased in ship barnacles as nautical as Nantucket!

This anomaly of barnacles on the desert sage was not written into Nature's original blueprints, but came as result of a war waged half a world away.

Lying 250 feet below ocean tide level, California's Salton Sea spreads indolently across many thousand acres of Imperial and Riverside counties. Due to the high salinity of its water, which carries nineteen chemicals in solution, the huge desert lake boasts few species of life other than mullet, mosquito fish, migratory minnows and a few microscopic types of life that only a scientist could love.

Early in World War II, the south shore of this inland sea became the site of a Naval training station, and the age-long peace of the desert was broken by around-the-clock arrivals and departures of PBY flying boats and other types of amphibious planes. Before many months of operation, desert dwellers were amazed to find ordinary sea barnacles forming on every piling and float, every scrap of driftwood or transient twig!

Believed to have been brought in as spawn on ropes, buoys, or other equipment used at the Naval base, or, possibly, in the bilge water pumped from PBY planes, the marine mollusks have been classified by Dr. Martin W. Johnson of the University of California's Scripps Institute of Oceanography as *Balanus amphitrite*. Due likely to their enforced change of diet, the species has already developed definite physical changes, and by some authorities is given varietal distinction as *B. amphitrite saltonensis*. Most pronounced change has been a lessening in size and development of a more fragile shell structure.

Salton Sea has long been a favorite waterway for marine speedboat racing, and swimming. Should these wayward mollusks continue to thrive, it is believed that it may prove feasible to stock the lake with other forms of marine life, including game fish, clams and oysters. Initial steps toward introduction of game fish was taken recently when the California Fish and Game Commission stocked the lake with several tons of Mexican anchovies. If these small fish survive the changed environment, they will automatically assure a food supply for larger fish, thus paving the way for introduction of more important and useful varieties.

Some Flavors and Scents

By E. LAURENCE PALMER

Illustrated by Nancy Harrington

This is the sixty-first in NATURE MAGAZINE'S *series of educational inserts.*

GUAVA

CINNAMON

CITRON

WHEN we see a huge bull being led around an exhibition ring by its nose, we are inclined to wonder how such a massive animal may be controlled by such a small portion of its anatomy. The bull follows his nose, because, if he does not, the ring in it hurts him. There are plenty of other animals that are led about the world by sensations that come to them through their noses, and plenty of others that become equally submissive to things that have a particular appeal to their palates.

In a dog's world, made largely of scents, man probably would be the lowliest of morons, and yet no man would deny that there are odors that attract him just as much as other odors annoy him. We use scents in the form of perfumes to attract other human beings, whether the scent comes from a perfume shop to be absorbed by my lady's gown, or whether it comes from an array of bottles in the barber shop to drench the old man's crown. Not infrequently, these scents are used to deceive, just as flavors are frequently used to deceive as to the nature of foods that we may eat. The radio, and the advertising pages of the press, tell us of all sorts of ways of disguising body odors by the use of perfumes, thus avoiding the sometimes obviously needed bath. The radio announcers go into ecstasies about the gentle melding of exquisite flavors and scents by the world's best expert makers of soups, soaps, and I almost said socks, since scents that come from the feet frequently influence our evaluation of those with whom we may be closely associated. The flavors and scents of soups or soaps are things to be courted; the scents from socks those to be eliminated. Encouragement and discouragement both call on the best our odor-experts have to offer.

We have elected in this insert to acquaint you with a

MIGNONETTE

NUTMEG

PAPAYA

WILD BERGAMOT

LAVENDER

OLIVE

few sources of scents and flavors that have not previously been considered in this series. The special insert on the herb gardens introduced you to some others that were not covered in still other units. We also elect to consider here only plants that serve as sources of fragrance or flavor. Possibly, sometime in the future, we may have a number dealing with animal sources of these materials. Such an insert would have to consider many important chapters in history during which explorers like Marco Polo risked their lives, fortunes and reputations, but were rewarded by bringing back to their part of the civilized world new fragrances, new savorings for which they received varied rewards. Any consideration of the use of animal scents would have to take into consideration the use of such scents in trapping fur-bearing animals for the production of that luxury of our civilized world, the fur coat. It might well lead to a study of how widely roaming animals manage to bring the different sexes together and effect the survival of the species. There are, in fact, so many things suggested by this approach that, unless we arbitrarily reject it at this point, we would not be able to do justice to the plant sources of scents and flavors.

One need not assume, from what has just been written, that plants do not yield scents and flavors that influence the behavior of animals. A considerable acreage of land in the country is used for raising catnip for the production of catnip oil, some of which is used, strange to say, to entice wild kinds of cats to traps. This story was suggested in an earlier insert.

It is quite probable that most of us who are influenced by scents and flavors are capricious in our preferences. Few of us know, or care to know, the story behind the alluring scent or flavor that brings us again and again to purchase this or that kind of food, perfume or soap. In fact, those who prepare these commercial materials find it to their advantage to keep us in ignorance on the matter, otherwise we might go directly to the source of supply rather than pay through the nose for our ignorance. The nicely blended flavors of particular drinks or foods that may be composed of commonplace essentials may be of such commercial importance that great sections of our country's economy may depend on their remaining known to few. For the most part, most of us are content to be led around by the nose by the commercial advertisers, who tell us that appreciation of this or that particular scent or flavor is the thing that gives us a special mark of distinction. We probably overlook the deception used by those who seek to get us to deceive others into thinking sometimes that we are what we are not. But, it is neither so simple nor so discouraging as that might seem, because there are subtle fragrances that are genuinely satisfying, irrespective of their relation to high pressure sales programs. These nicely modulated titillations of our senses, for the most part, make us happy and popular, and, if this is the case, then those who help us to attain such a status are, of course, entitled to a suitable reward. This is a part and parcel of the philosophy of individual enterprise, which has made our democracy so successful that we are the envy of the world.

THYME

CAPER

Now, how do we become acquainted with most of the things considered in the chart section of this insert. Our spice cabinet and our grocery store yield nutmeg and cinnamon, which we sprinkle on our toast, our malted milks or our pies. Jellies of guava, roasts peppered with cloves, pickles flavored with dill, olives served as appetizers, or as parts of sandwich mixes, are only a few of the points of contact we have with the plants that here interest us. The question is whether such words as guava, dill and cinnamon mean anything to us. When we dream over a food flavored by these plant materials, do we draw a blank, or do we see the far lands from which some of them come. When we have capers in our soups, or okra joining the capers, do we have any idea about how these welcome additions to popular dishes are produced. Do we see any significance in the phrase "cutting capers;" a descriptive

DILL

OKRA

LEMON BALM

GARDENIA

saying that gives us a new appreciation of the capers in our salads. And, when we consider salads, we open a whole new vista of interesting plants that contribute largely, or in minor degree, to our happiness in living. Papaya, limes, and now and then a little candied citron, have condiment qualities that can make or break a meal for some persons.

Are these words and flavors such as citron, lime, dill, okra and papaya really significant to us? Do we know from what part of the plants the things we consume come; where the plants grow; how their useful parts are processed; why they may cost so much and what role they may have played in the history of the world? The British Empire may well have been built on the lime, in view of its contribution to the health of British sailors, who sailed and ruled the high seas when that empire was being built. Does appreciation of this fact add something to the satisfaction we may get from a slice of lime beside a broiled fish, or saddling the edge of a glass with a cold drink inside? Do we realize the extent to which we have come to accept, as a normal item available in markets, plant materials that cannot be grown successfully in our country, and which might vanish should the world become divided into two great camps, each denying the other things to which they have long been accustomed? True, we in America have again and again called upon our chemists to produce synthetically what has normally been produced by Nature, but we hope that the time will never come when we cannot maintain cordial relationships with people of lands remote from ours. Does anyone think he could produce a synthetic cantaloupe or strawberry? Why think we can ever do the same for a papaya?

CLOVE

LIME

When we consider the scents, we find a varied group of interesting approaches. Lavender is associated with old lace by many a theater-goer who would not know lavender if he saw it, to say nothing of smelling it. He would know a gardenia because it is sold outside the theater in the greater crossroads of the world. Should the average city man see the name mignonette, he would have some difficulty in pronouncing it, no doubt, but even should he be able to succeed there, he could not truly appreciate the fragrance of the plant unless he had been brought up on it as a part of his grandmother's garden. He would seek in vain for this plant in the modern flower garden dictated by the landscape artist.

Mignonette has a personality all its own, and, to be truly appreciated, it must have a significant history to the one who wears it. It represents the country, while heliotrope was in the buttonhole of city dandy a few generations ago, just as gardenias now are the standard essence of the urban boutonniere or corsage. I like gardenias, true, but there is something that I find in mignonette and heliotrope that I will never find in the gardenia, no matter how long I live or what the dictators of fashion may say. And, while mignonette, lavender and heliotrope hold an undisputed place in our list of old-fashioned fragrances, even these lack something I find in wild plants that our less prosperous ancestors used as substitutes for the orthodox stuff they sprinkled on the handkerchiefs in the bureau drawer. Who is to tell me, or you, what we think is fragrant? I even like a little oil of pennyroyal, and many is the time when I stop on a field trip, winter or summer, and rub some of the plants on the palms of my hands just to get the fragrance of the oil.

Of course, the poets and (Continued on page 256)

NAME SCIENTIFIC NAME	MIGNONETTE *Reseda odorata*	CITRON *Citrus medica*	LIME *Citrus aurantifolia*	GUAVA *Psidium guajava*
DESCRIPTION	Order Papaverales; Family Resedaceae. Much branched, at first being erect, but eventually sprawling and wide spreading. Leaves mostly entire, but sometimes notched, blunt-ended except in the white mignonette, where they are deep notched, or cut to a central midrib. Highly variable in its many cultivated forms. Annual.	Order Geraniales; Family Rutaceae. Small, shrubby tree armed with stout spines that are short and abundant. Leaves to 9 inches long, with no wing on the petiole, blunt or with short point and with margins shallowly toothed; no apparent joint between the petiole and the leaf blade, the whole leaf appearing to be large for a citrus plant.	Order Geraniales; Family Rutaceae. Relatively small tree that bears short, stiff, sharp spines and appears to be very smooth. Leaves short, to only 3 inches long, blunt or slightly rounded at tip and with the short, definitely and narrowly winged petiole plainly jointed to the blade. Leaves shine slightly.	Order Myrtales; Family Myrtaceae. Tree or shrub. Branches usually close to the ground. Slender. Height to 30 feet. Bark scaly, greenish-brown and smooth. Twigs more or less 4-angled. Leaves opposite, to 5 inches long, finely downy beneath, with veins above conspicuously impressed and raised below, to 2½ inches broad, with petiole to 2¼ inches long.
RANGE AND RELATIONSHIP	Native of northern Africa and related to some 50 or 60 other species, mostly natives of areas essentially adjacent to the Mediterranean and the Red Sea. It grows reasonably well in the average garden soil, or in pots indoors, requiring little care for the pleasure it gives.	Native of Asia and grown to some extent in the United States in California and in Florida, but most popular as a cultivated plant in the Mediterranean region. It probably originated in India and was cultivated in the fourth century B.C. Was described by Theophrastus as being found in Babylon. It is probably the oldest cultivated citrus.	Native of Asia and grown throughout the tropics but more particularly in Italy, the West Indies and Florida. It is distinctly a tropical plant. Ceylon, India and Mexico are important commercial centers for the production of limes. Most of the limes used in the United States are necessarily imported.	Native of tropical America. Naturalized in Hawaii. Grown under some cultivation in Florida and southern California. May have been native as far south as Peru. Different areas now have more or less unique varieties that are most common. There are some 150 species in the genus all native of tropical and subtropical America.
REPRODUCTION	Flowers yellow-white, the petals being finely cut and the anthers being bright yellow. There are many stamens attached to one side of the flower. Flowers are borne in rather open terminal spikes and are exceptionally fragrant. Fruit a capsule, opening at the top to free the seeds.	Flowers in clusters in the leaf axils; attractive, white inside and purplish outside, large, to more than 1½ inch across, with 30 or more stamens. Fruit oval to oblong, to 10 inches long, lemon yellow when ripe, fragrant, with rough, thick, warty skin and small, acid pulp.	Flowers relatively few, borne in the axils of the leaves, usually under ½-inch long, white throughout, fragrant, with 20 to 25 stamens. Fruit, when ripe, pale greenish-yellow, thin-skinned, with an abundant highly acid pulp and oval, jointed juice sacs, to 2½ inches through, sometimes with a small nipple, to 10 segments and mildly rough.	Flowers solitary or in clusters of 2 or 3 on recent wood, white, about an inch across, with calyx splitting into 2 to 4 even segments and whitish within. Corolla of 4 or 5 petals, each to ¾-inch long and spreading. Stamens erect or spreading, numerous, in groups, on half-inch filaments and with pale yellow anthers. Fruit 1 to 4 globes, yellow.
CULTIVATION	For growing in the garden, the seeds are planted in May and July, if a steady yield of blossoms is to be desired. They may be planted in pots at almost any time of the year and when this is done may be moved from room to room, giving a fragrance of which someone said, "Its sweetness wins all hearts."	Citron cultivated chiefly in Greece, West Indies, Corsica, Sicily for the essential oil cedrat extracted from rind for use in perfumery and for candied rind used as a condiment. Other citrus fruits of minor importance are bergamot, *C. bergamia*, raised for oil of bergamot and calamondin, *C. mitis*, used in beverages.	One of the sourest of the fruits and naturally unsuitable for unmodified eating. The plant is grown mostly for the juice that is extracted and shipped raw or in concentrated form for a variety of uses. Oil of lime is extracted from the rind. Florida has produced 10,000 boxes of limes a year. Limes cannot be packed and stored as can lemons.	Known to have been under cultivation before Columbus discovered America; was known to the Incas. Berry-like fruit has varied colored flesh but is aromatic, sweet, juicy and highly flavored and contains acid, sugar and pectin in a pleasing combination. Popular as a fresh fruit or more particularly as a basis for jams, jellies and pastes.
ECONOMIC IMPORTANCE	Latin name means to appease or to calm. The Romans used the flowers to rub on bruises. Some are grown for the showiness of the flowers, but usually the larger the flowers of a variety, the less its fragrance. While there are many rivals for beauty, there are few rivals for the mignonette's fragrance.	Candied citron, for which plant is grown chiefly, is made by extracting bitter oil from rind with brine then candying the rind in sugar and glucose solution. A normal annual yield of citron is about 6000 tons of which the United States uses about half and raises only a small proportion. It is one of the most expensive of condiments.	Although lime juice is famous as a scurvy preventative, it really contains only about ¼ as much vitamin C as either oranges or grapefruit. It is used mostly as a flavoring for beverages, medicinally and as a source of citric acid. The plant is much more susceptible to cold than are most other citrus trees.	The related eugenias include some 700 species, and the whole group provides many valuable tropical fruits. Among these are the rose apple, *Eugenia jambos*, with green and yellow fruits, now grown in Florida; the pitanga, *E. uniflora*, grown in Florida and California for jellies and sherbets; the jaboticaba, *E. cauliflora*, and the *Feijoa sellowiana*.

CLOVES *Eugenia caryophyllata (aromatica)*	WILD BERGAMOT *Monarda fistulosa*	LEMON BALM. BEE BALM *Melissa officinalis*	BASIL *Satureia vulgaris*	THYME *Thymus vulgaris*
Order Myrtales; Family Myrtaceae. Tree. Height to more than 40 feet. Generally small, symmetrical, conical, evergreen. Leaves opposite, conspicuously tapering at the base, petioled, to 5 inches long, conspicuously veined with the lateral veins parallel and the cross-veins less showy. Root system rather poor so that the tree should be protected from wind.	Order Polemoniales, Family Labiatae. Height to 3 feet. Stem much branched, rather slender, finely fuzzy or strictly smooth, whole plant often making considerable clumps of vegetation. Leaves opposite, thin, to 4 inches long and to 2½ inches wide, pointed at the tip and usually rounded or heart-shaped at the base of the blade, rather pale green, conspicuously veined.	Order Polemoniales; Family Labiatae. Height to 2½ feet. Stem 4-angled, stout, erect or ascending, loosely branched, somewhat hairy, rather strongly aromatic at all times. Leaves: opposite, petioled, to 3 inches long with blade sometimes almost as wide as long, with margin shallowly and not abundantly toothed, rather blunt at each end. Perennial.	Order Polemoniales; Family Labiatae. Height to 2 feet. Stem branched but more commonly unbranched, 4 angled, erect or ascending from a sprawling base, with creeping stems that root at the joints freely. Leaves opposite, entire or nearly so, or vaguely toothed, to 2½ inches long and about ½ as wide, with usually relatively short petioles, thin, fragrant.	Order Polemoniales; Family Labiatae. Height to 8 inches. Erect, or nearly so, with slender whitish branches that are stiff and woody and 4 angled. Leaves to ¼-inch long, slender, clustered at the joints, without petioles, fragrant, entire. The related wild thyme has leaves with short petioles and stems that are more sprawling.
Native of Moluccas but widely cultivated in the tropics. Discovered by the Portuguese in the Moluccas in the 16th Century and was a Portuguese, then a Dutch, monopoly. Now grown extensively in both hemispheres where conditions are suitable. More than a thousand species in the genus, including many important commercial plants.	Native of North America. Found growing in thickets, on dry hills or in open prairie lands from Maine to Florida and west to Arizona and British Columbia. In Virginia it may reach an elevation of 2500 feet. This is not the bergamot of commerce.	Found in woods and waste places, in or out of the shade, from Maine to Georgia and west to California and Oregon. Also found native in southern Europe, where it has been under cultivation for a long time. There are 4 species of the genus native of Europe and Asia, of which this one is established in America.	Found native in America and in Europe and Asia, in woods, thickets or along paths and roadsides but usually not abundant in a given place. Grows from Newfoundland to North Carolina and west to Arizona, Manitoba and the Rocky Mountain region. Found at 4000-foot elevation in Virginia. About 60 species in the genus in north temperate regions.	Native of southern Europe but grown rather widely as a rather common garden plant that may live for many years under proper treatment. There are about 50 species in the genus to be found native in Europe, for the most part. Our naturalized wild thyme, *T. serpyllum*, is also a native of Europe.
Flowers pale purple, about ¼-inch across and in terminal branching clusters. Wild flowers are crimson. Shape like a nail, hence name "clove," from *clou*, meaning nail in French. Buds are picked by hand from August to December in Zanzibar, from November to January in the Straits Settlements, and in the Spice Islands in July and in December.	Flowers usually in heads at the ends of the major branches but sometimes also in the axils of the uppermost leaves. Calyx with teeth rarely longer than the diameter of the corolla tube. Corolla pale blue, lilac to purple or a yellowish-pink, to 1½-inch long, with stamens extending beyond the limit of the upper lip. Fruit hard nutlets.	Flowers in whorled clusters in the axils of the upper leaves but with the flowers not too crowded in a whorl. Calyx about 1/3-inch long with the lower teeth longer than the upper. Corolla yellow or white, to more than ½-inch long, not too conspicuous. Flowers appear from June through August. Fruit smooth nutlets.	Flowers in whorls in the axils of the upper pairs of leaves. Calyx somewhat swollen at the base, with the teeth about half the calyx length and pointed, fuzzy. Corolla pink, purple or white, and about twice the length of the calyx, with the whole clusters having a diameter of about 1 inch. Fruits egg-shaped, smooth nutlets.	Flowers in many-flowered whorled clusters loosely crowded along the stems, but the heads themselves rather compact. Calyx hairy at the throat and about as long as the individual flower stalks. Corolla with the tube only about as long as that of the calyx, lilac or purplish.
Trees produce from 6th to 30th year, but may yield for 150 years. New trees continually added to plantation. Tree normally may yield 5 to 20 pounds in a year, but some may yield 75 pounds. There are 4000 to 5000 cloves in a pound since they are dried thoroughly in sun or otherwise, and are individually light.	Flowering time is from June through September, although the plants may appear conspicuously through the winter. The *Monarda* of the prairie region is *M. mollis*, the pale wild bergamot with flowers that are yellowish or lilac or pink and slightly smaller but much more abundant than those of this species.	Grows in any good garden soil and propagated from seeds, by cuttings or by root division. Seeds are sown in early spring, usually in flats in greenhouse, and soil must be fine. At 4 inches seedlings are transplanted into rows with plants a foot apart. Cultivation must be frequent to prevent weed competition. Crop cut in full flower.	Flowering time is from June through October, with small bees and flies effecting pollination. Not considered as a pernicious weed but sometimes needs control locally. This is simple since it yields to cultivation or to plowing, although rarely patches may have to be dug out and destroyed. Also yields to the commoner weed-killers.	Seeds sown in early spring in drills 3 feet apart, or sown indoors to be transplanted 18 inches apart in rows to 2 feet apart. Cuttings handled like those of geraniums rooted in sand under glass. Plants do well in mellow medium rich soil if kept free of weeds during the growing season.
Used as spices, either ground or whole. Buds yield to 20% clove oil and stems to 5%. Distillation is by steam. Oil used in medicine as a local antiseptic, to aid digestion and as antispasmodic; also in tooth pastes, in perfumes, as a clearing agent in histological work and as imitation carnation perfume. Zanzibar produces 90% of supply.	The bergamot of commerce that produces the oil of bergamot is not even a member of this family. Rather it is *Citrus bergamia*, a member of the same genus as that to which our oranges and lemons and grape fruits belong. Oil of bergamot is extracted from the rind of the fruits of that plant.	An acre may yield 1800 pounds of dry herb, but it is usually less. Flowering tops are used as a crude drug with drying being done in shade to preserve color. Leaves are also used in culinary practices for flavoring, and oil distilled from plant is used in flavorings and in perfumery.	Not important as a source of medicine or of flavoring or of perfume. It is just a weed that to the average person seems a bit different, although it is obviously a mint from its fragrance and for other reasons. It is known as horse thyme, field thyme, or as dog mint, indicating it has attracted popular attention.	Dry flowering tops are used in flavoring, being harvested in full bloom. At best may yield to a ton of dry top per acre, worth to 11 cents a pound, the yield building up to this maximum over the years. Oil, extracted by steam distillation of green tops, is worth to $1.45 a pound. There is great variation in yield.

NAME SCIENTIFIC NAME	LAVENDER *Lavandula spica*	GARDENIA *Gardenia jasminoides (veitchii)*	OLIVE *Olea europea*	DILL *Anethum graveolens*
DESCRIPTION	Order Polemoniales; Family Labiatae. Shrub or semi-shrub. Height to 3 feet, but usually lower. Leaves crowded near the bases of the branches, or clustered at the joints, white fuzzy, to 2 inches long, entire, with margins turned backward. Leaves of the flowering portions short and sharply pointed. All leaves are slender.	Order Rubiales; Family Rubiaceae. Shrub. Height to 6 feet. Variable, with stems often rooting in contact with soil. Twigs unarmed. Leaves opposite, whorled or crowded, dark, lustrous green, thick, evergreen, sometimes with light markings, to 4 inches long, with short, sharp point at free end, most attractive and clean looking.	Order Gentianales; Family Oleaceae. Tree. Height to about 40 feet. Twigs relatively slender. Leaves evergreen, alternate or opposite, leathery, entire, 2 inches or more long and narrow, often with rusty hairs on the under surface. In variety *Oleaster*, the wild form, the twigs are angled in cross-section and thorny.	Order Umbellales; Family Umbelliferae. Annual or perennial herb. Height to more than 3 feet. Slender, much branched in the upper portions, with long vertical markings. Leaves much like those of fennel *Foeniculum*, with unusually fine, narrow segments, basically divided into 3 portions, each of which is subdivided. Petioles ragged marginned, strongly veined.
RANGE AND RELATIONSHIP	Native of the Mediterranean region but widely cultivated in Europe and, to some extent, in America. Some recognize this as the true lavender, but others apply this name to the larger *L. vera*, which is not so white as this species. At least three species are recognized as being worthy of cultivation, including *L. latifolia* and *L. dentata*.	Native of China. Now widely grown by florists for sale of the cut flowers. *G. veitchii* apparently was developed from the older *G. jasminoides*, or Cape jasmine, in order that flowers might be produced when the market was best. *G. florida* may also belong with this species, or at least is very close to it.	Cultivated since early times and introduced into the Mediterranean area by the Phoenecians, Greeks and Romans. Now widely cultivated in suitable territory in America, Africa and Australia, as well as in Eurasia. In America is cultivated in Arizona, New Mexico, California and Florida. Spanish padres planted first trees in California.	Introduced from Europe but rather well established, as an escape and otherwise, in waste grounds or at garden margins from Connecticut to Virginia and probably elsewhere. It is established in some parts of the West Indies. There are two species native originally from Asia but established in southeastern Europe before introduction here.
REPRODUCTION	Flowers borne in clusters of to 10 flowers in whorls at the joints to form spikes with unflowered spaces between the whorls. Calyx tubular, 5-toothed, with many nerves. Corolla lavender colored, to ½-inch long, with the lobes nearly equal to each other, and with 4 stamens that are included within the corolla tube.	Flower waxy, white, single or double, to about 3 inches across, camellia-like, most fragrant. Tube of corolla much longer than calyx, cylindric, with a smooth throat breaking into to more than 10, recurved, immaculate lobes. Tube longer than 5-toothed calyx. Stamens to 9, grown on throat of corolla.	Flowers inconspicuous, greenish-white or yellowish-white, fragrant, borne in axillary, forking, few-flowered clusters that spread rather widely. Calyx short and of 4 parts. Stamens 2. Fruit a well-known stone fruit, somewhat egg-shaped to oval, about 1 inch long, shining purple-black when ripe, bitter when untreated, heavy in oil.	Flowers borne in large, conspicuous open and loose compound umbels that may total to 6 inches broad, with the major rays to 3 inches long and often weak and sagging, and the minor rays to 7 inches, long and slender. Flowers are yellow. Fruits about ¼-inch long, elliptic, flattened from the back with the lateral ribs extending into wings.
CULTIVATION	Does best in dry, limy soils, but will grow on any well-drained soil. Winter kills on low wet soils. Grown from seeds or by division of root system. Carried through winter indoors, in cold frames or under mulch. Rooted cuttings may be set in spring in rows spaced about 1 foot apart. Crop at best in 2 or 3 years.	Culture is most difficult. Cuttings are made in winter and set in sand or earth at 75° to 85°F. bottom heat. When rooted, are potted in loam, rotted cow manure and sand and kept where night temperature does not go below 65°F. By June, plants are set in benches, but, during summer, temperature should not go above 95°F.	Trees require a deep soil that is fertile where the temperature averages 75°F. and never goes below 14°F., and where water is available by irrigation or otherwise. Propagation is by cuttings, which are frequently grafted on wild stock in place. Fruits picked full grown but unripe are cleaned, picked by hand, heated with lye and pickled in brine.	Flowering time is from July through September, so the fruits are harvested later. The fruits are bitter if eaten raw but are ground and used in making flavoring, such as in making dill pickles. It is believed that the name dill refers to the Greek meaning to burn, which refers to the taste of the fruits.
ECONOMIC IMPORTANCE	An acre may yield to 1200 lbs. of dried tops or 4/5 the green weight. Tops harvested when in full bloom. Flowers dried worth more than 35 to 70 cents a pound. Acre may yield to 15 lbs. of oil worth to more than $7 a pound. Oil is distilled from the green tops. All products used as perfumes of one sort or another. As old fashioned as "lavender and old lace."	One of the most valuable of the cut flowers of our greenhouse industry, individual flowers retailing for a dollar or more. Insect pests such as the mealy bugs, and the great sensitivity of the plants, make production costs high but the returns are even higher, so there is profit. Flowers represent best in beauty.	Olives are eaten pickled. Olive oil is important as a lubricant, as a basis for cooking oils and salad oils, in the arts as a non drying oil, does not become rancid soon unless exposed to the air. Spain, Italy and Greece are among the leading olive producing countries, and California leads in the States of the United States.	Propagation is by means of the fruits sown in warm location. The foliage may be used in flavoring, as well as the fruits, and there are some medicinal properties that are assumed or may be real. Leaves are used in India and Russia. In France and India the seeds are used in soups. Oil extracted from the seeds yields the medicine.

PAPAYA. PAWPAW *Carica papaya*	OKRA *Hibiscus esculentus*	NUTMEG *Myristica fragrans*	CINNAMON TREE *Cinnamomum zeylanicum*	CAPER BUSH *Capparis spinosa*
Order Violales; Family Caricaceae. Tree. Height to 25 feet. Erect trunk, without side branches, but sometimes dividing to form several erect stems, at the top of which are a cluster of leaves. Leaves to 2 feet across, nearly round in outline but usually deeply lobed with about 7 lobes, each of which is in turn lobed. Petioles hollow to more than 2 feet long.	Order Malvales; Family Malvaceae. Height to 6 feet. Coarse annual or perennial, stout, smooth and becoming tough and fibrous with age. Leaves to more than a foot across, more or less heart-shaped or oval, or divided into 3 to 9 narrow or broad lobes or divisions, with coarsely toother margins. Root-system such that the mature plant is not easily transplanted.	Order Ranunculales; Family Myristicaceae. Tree. Height to 60 feet. Smooth, with rather coarse branches that may droop at the ends. Leaves evergreen, dark green, sometimes pale yellowish-brown, petioled, to 5 inches long, elliptic to more slender, some with whitish under surfaces and the 3 rather conspicuous veins not parallel, alternate, entire.	Order Ranunculales; Family Lauraceae. Tree. Height to 30 feet, but under cultivation is kept to lower level. Bark fragrant, leathery. Leaves stiff, evergreen, dark green, leathery, to 7 inches long, blunt or pointed, opposite, usually somewhat drooping, usually somewhat shorter than flower clusters. Tree is freely branching when left alone.	Order Papaverales; Family Capparidaceae. Shrub growing to height of 3 or 4 feet. Spiny, straggling. Leaves to 2 inches long, with short petioles and two backward-pointing spines at base of each. There are spineless varieties but the commoner type is definitely spined as indicated.
Native of tropical America but under cultivation widely in the tropical world, and likely to be of increasing importance as a commercial tropical plant. There are about 25 species of the genus native to tropical and subtropical America. This species probably originated in Mexico and Central America.	Native of the Old World tropics, but introduced and established in America and the West Indies, where it finds some popularity as a cultivated plant. It is closely related to the rose of Sharon, to flower of an hour, and to the many species of ornamental hibiscus commonly grown in gardens and along highways in the tropics.	Native of the Molucca or Spice Islands between Celebes and New Guinea in Dutch East Indies, but now grown in the tropics in both hemispheres. There are 8 genera and more than 100 species in the family, of which 80 species are in this genus, and all of which are native of the India, Australia area.	Native to India and Ceylon and grown widely in tropics, although for years Portuguese, then Dutch, then English maintained a monopoly in Ceylon. Now grown to some extent in South America and in West Indies. Related camphor tree, *C. camphora*, has large-scaled buds that are lacking in this species, and a height of 40 feet.	Native of the countries along the Mediterranean, where, in Nature, it sprawls over old walls and other low elevated areas. It has a picturesque appearance. There are about 150 species of the genus, but this one has been cultivated in various parts of the world.
Flowers typically either staminate or pistillate, with the two on separate plants. Staminate in slender clusters that are to more than 2 feet long. Yellow, to 1 inch broad. Pistillate solitary or in small clusters, yellow, to 1 inch broad. Fruit like a spherical, yellow or orange melon to 20 inches long.	Flowers solitary or axillary, or more or less clustered, yellow, with a reddish center, with petals to 3 inches long and the typical mallow center and with 1-inch bracts that fall from the developing fruit. Fruit with a long beak, ribbed, smooth or somewhat hairy, becoming tough with age, to 1 foot long.	Staminate and pistillate flowers usually are borne on separate trees and are small, pale, yellow, fleshy, fragrant. There is no corolla and the few to many stamens are grown together. Fruit pear-shaped to globular, to 2 inches long, reddish or yellow, splitting in two showing the scarlet mace that surrounds the nutmeg in its shell.	Flowers are numerous, relatively inconspicuous, yellow to white, borne in loose, silky, hanging clusters, with fruits developing into dry, pointed structures that are to 2/3-inch long and have general appearance of blackish berries.	Flowers white, to 2 inches across, with 4 petals, about an inch long, and 4 sepals. Stamens are longer than petals and fruiting area in center is longer than the stamens. Fruit a berry with many seeds and long stalked. Berry globular or cylindrical.
A food and drug plant grown chiefly in West Indies, Ceylon, India, Malay, California, Florida and Hawaii for fleshy fruits that weigh to 20 pounds. Plant yields a milky juice used in manufacturing chewing gum and which contains the digestive ferment papain that like pepsin stimulates digestion.	Seeds planted in rows to 5 feet apart, to 2 inches deep and as the plants mature the poorer individuals are removed. A plant may survive many years if not killed by frost. If kept properly cut back may yield valuable fruits for a long time. It has many fungous diseases and so rotation is practiced to keep cultures clean.	Brown seed encloses the nutmeg meat, which is the source of commercial nutmeg, while mace comes from the red seed covering. Propagated from seed, a tree near sea may come to full bearing in 15 years, yielding to 10,000 nutmegs a year. Fruits are produced the year round, but tree requires hot moist climate.	In cultivation trees or shrubs are frequently cut back twice a year, and the bark is removed from the long, slender shoots that arise and the inner part scraped. Dried bark is tied in bundles and sold. Waste is used as source of oil of cinnamon, which is much less valuable than bark.	In northern United States, capers are grown in greenhouses, but in the South they may be grown from seed in open. In North, propagation is commonly by wood cuttings. Most extensive cultivation of capers is found in Sicily and in other southern European areas.
Fruits commercially valuable and now being shipped into temperate zone markets. Orange flesh has a sweet, musky taste and is used in sherbets, salads, pies and confections, or eaten as a breakfast fruit. To the writer it tastes like an overripe cantaloupe. Tree looks like a pole with melons and leaves on top.	Fruits cut young and before they are stringy are used in soups and chowders or in stews, where they become highly mucilaginous and add "body" to the mixture. They are not universally liked but a taste for them develops rather easily. Seeds are sometimes collected, roasted and used as a coffee substitute. Market for okra or gumbo is established.	Nutmegs are ground to make a strong spice. Mace is a delicate spice used in flavoring ketchup and sauces. Nutmegs are used medicinally and as general flavoring. Essential oil, myristicin, can be used only sparingly but is used in tooth pastes, tobacco flavoring and perfumes. Nutmeg butter is used in salves and in candles.	Cinnamon used chiefly as a flavoring for candy, pies, toast, gum, incense, tooth pastes, perfumes, and, to some extent, as a medicinal stimulant. Oil is used as an astringent and antiseptic and is sometimes used in soaps. Camphor from the related species is distilled from the wood of trees at least 50 years old. Grown in Florida.	Flower buds are basis of capers eaten; are collected fresh through flowering period of summer and autumn; kept in vinegar and salt to season's end. They are then graded and better ones packed in bottles. Common use is as a sauce for mutton, as a salad dressing, or as a general appetizer. Capers have a biting taste. Spines annoy pickers hence "cutting capers."

(Continued from page 251)

essayists have not neglected consideration of fragrant plants. In *Midsummer Night's Dream* Shakespeare has Oberon, King of the Fairies, tell Puck:

"I know a bank whereupon the wild thyme blows,
Where ox-lips and the nodding violet grows;
Quite overcanopied with lush woodbine,
With sweet musk-roses and with eglantine."

While Shakespeare, in another place, speaks of thyme as "pun-provoking thyme," there is no doubt but that he and others appreciate the fragrance of the plant. The French writer, Montaigne, emphasizes the contribution of thyme to the fragrance of honey, but says that, while the bees collect nectar from it and from other plants, they work on it until it is no longer thyme (*n'est pas thym*') nor any other fragrant plant but a work of the bee's own (*un ouvrage tout sien*). His implication that the honey maker is a male is interesting. Even Milton, in *Paradise Lost*, calls attention to the relationship between bees and citron, one of the plants selected for special consideration here.

Thackeray, in *The Virginians*, confirms our earlier reference to the use of lavender in perfuming stored fabrics by writing: "What woman, however old, has not the bridal favours and raiment stowed away, and packed in lavender, in the inmost cupboards of her heart?" I wonder if that is as true in this modern age as it was in Thackeray's. It may again confirm my dating of these fragrant plants when I say that I have been unable to find mention of gardenias in the writings of those older masters, who so glibly refer to thyme and myrrh and lavender.

When we seek reference to the plants that add flavor to our foods, we find Ben Johnson building up an appetite for a meal along these lines:

"Yet shall you have to rectify your palate,
An olive, capers, or some better salad
Ushering the mutton; with a short-legged hen,
If you can get her, full of eggs, and then,
Limons and wine for sauce, to these a coney
Is not to be despaired of for our money."

Of the more prosaic aspects of turning fragrant and savory plants into commercial assets, we shall here say little. Specific reference to many of the pertinent techniques are given in the accompanying chart material. Of one thing we are certain, and that is that when we speak of the "essence" of this or that, we really mean that. An acre of land cultivating bee balm for use in perfumery rarely yields more than 1800 pounds of the dry herbs from which the essential oils are yet to be distilled for flavoring or perfumery. The distillation process in collecting the needed essences is highly varied. Some plants give the greatest return when they are in full bloom, while others give greater returns at other times. In some, the needed products are extracted by steam, in others alcohol is used to separate what is wanted from that which is to be rejected.

BASIL

And, if the processing of these materials is interesting, then the story of the cultivation of the basic plants is equally intriguing. Some must be grown in shade, while others require full sunlight. Some mature early in the season, while others come later. Some require dry weather and dry soil, while others may not do well in such situations. In some, the wild plants can be and have been improved by cultivation to such a point that they yield much more than is the case with the wild plants. We get some of the materials we wish from the flowers of the plants, while others give us what we need from their roots, stems, leaves, or fruits. We harvest some of the plants yielding the materials we seek by collecting the plants in spring. Others are ready for harvest later in the summer, and still others are gathered in the autumn. Some make their growth in a single season, while others spend many years reaching the point where they produce useful materials. If you have never tried to keep heliotrope plants indoors in winter, in the hope that they may produce flowers for you in off seasons, you may have some interesting experiences when first you try.

The makers of jams and jellies, of pies and cookies, of breads and cakes now and then find a use for some of our plants. The proper blending of these important fragrances is something about which I have no authority to write. I can only state that there is a difference between the palatability of foods cooked by some of the older culinary artists and these produced by some of the can-opener delicatessen generation.

It may be that, as time goes on and as the chemists and physicists know more about foods and their preparation, a time may come when we can produce synthetically scents and flavors equal to or superior to those of the good old times. We do produce many of these things artificially. Possibly, should wars split our world, we will be stimulated to even greater effort and reach even greater successes than we have in the past. There is no reason why this may not be effected. Royal purple dyes, at one time apparently produced by the culture of indigo and under exorbitantly expensive procedures, were limited in their use to kings and their favorites. When the chemists found it possible to duplicate the dye much more reasonably, they came within the reach of all and promptly went out of style, even with the kings.

There seems to be some evidence that the time may come when the chemists may take over, for Nature, as much in the field of the production of scents and flavorings as they have in other fields, notably the plastic category. When that time comes, we all can enjoy something comparable to the palatability of what came from my grandmother's cookie jar, or the fragrance that came from linen stored upstairs in her house. If it can be duplicated and made available generally to the peoples of the world, I can not see any reason why we should have war. Everyone would be just too contented.

Conservation Education

CHARTING routes in education, and dealing with the relationship of the schools to issues of national importance, the Yearbook of the American Association of School Administrators is always a significant publication. The Twenty-ninth Yearbook bears the title *Conservation Education in American Schools*,* and is, to our possibly prejudiced mind, specially significant. This, then, is an editorial-review of a book for which we bespeak the widest possible circulation.

"To bring about the prudent use of natural resources in a democracy, large dependence must fall on education. . .Unless conservation education becomes much more general than it has been in the past, needless shortages soon will undermine the prosperity and welfare of our people." These two sentences are quoted from the foreword, which sounds the keynote of the aroused conviction of the Yearbook, "an administrator's guide, which defines a broad area of school responsibility and indicates what can be done about it."

Conservation is discussed as the "price of survival" in the first chapter of the book, which paints a broad picture of the conservation scene and the interrelation of its component parts; a philosophy that holds that "wise resource use must take into account the essential unity of all resources." It is urged that "The American people need to understand this essential unity of natural resources if conservation is to become an attitude, or way of life, in our democracy. Wise planning for resource use can be done only by those who are able to think broadly and to see the interdependences that exist."

Against this picture of conservation unity is projected the resumé of what has been done thus far; what agencies, governmental and private, have been given the responsibility of meeting the challenge of resource depletion and dislocation. And as to the challenge to the educator, it is emphasized that "All methods of disseminating information and all types of education will be needed, including a well-planned program of conservation education in all of the nation's schools. Youngsters now in school, who tomorrow will man the posts of government, industry, agriculture, and all other areas of economic and social life, must be led to an understanding of the natural processes that operate in their environment."

From both the point of view of the school administrator and the conservationist, the third chapter is important. It lays down specific guides for school programs; enunciates certain principles; emphasizes certain lacks and the means to supplying them. Inclusion of conservation in both elementary and secondary schools is urged, if children are "to acquire satisfactory insight into the various types of conservation problems, and develop functional conservation attitudes' habits, and skills. . ." It is pointed out that there is "no community or area in the United States, whether urban or rural, that does not have its major conservation needs."

As a matter of curriculum practice, it is proposed that conservation knowledge and experience be integrated into the prevailing curriculum, notably through social studies, the natural sciences, history and geography. The importance of outdoor, practical experience is emphasized, also, and cooperation is urged with all existing agencies in planning and participating in programs.

Turning to the teachers, the Yearbook asserts that they must be "helped to understand more clearly than most of them now do the problems of wise resource use," and if this is not achieved "there is little hope of widespread and effective conservation education in the schools." This should be accomplished through preservice training, supplemented by workshop participation, which activity is discussed in two chapters. The importance of training administrators is also stressed. It is pointed out that on account of "the relatively meager opportunities that are now available for preservice education for teachers and school administrators in the conservation of natural resources, a huge job of inservice education needs to be carried out." At the same time, we cannot safely rely on merely educating the coming generations; adult education today is equally important.

Surveys of school textbooks reveals them to be generally deficient in attention to conservation. Social science texts devote only a few pages; biology texts, for the most part, give the subject passing notice; history texts, although our whole history is based upon the use — and abuse — of natural resources, usually ignore conservation; geography textbooks discuss resources but lack interpretation in terms of conservation. It is pointed out that publishers strive to keep abreast of educational trends, and that when "teachers and administrators offer a clearer idea of the kind of conservation materials they want in science and social studies books, the textbook publishers will produce them." The sooner the better.

The Yearbook issues a "call to action" in no uncertain terms, when it outlines the responsibility of the schools by saying:

"If one accepts the modern school as an effective institution for the attainment of improved living, then a consideration of the conservation of natural resources as one phase of the school program is no longer debatable. The importance of the problems connected with the wise use of natural resources and the broad implications of these problems for the welfare of our people leave the school no alternative."

**Conservation Education in American Schools*. 527 pages. American Association of School Administrators, 1201 16th St., N.W., Washington 6, D.C. $4.00.

PHOTOGRAPH FROM WYMAN'S PHOTO SERVICE, FAIRBANKS

Aerial view of the University of Alaska. In the foreground are the new Geophysical Institute building, erected at a cost of nearly a million dollars, and six new houses for the University staff.

Alaska's University-Farthest North

By CHARLOTTE HILTON GREEN

"ALASKA has a rendezvous with destiny," said Governor Ernest Gruening, in 1943. Today it is just as true.

The Governor has also said: "If there is one institution of which the Territory may be rightly proud, it is the University of Alaska. No other agency has pioneered so usefully in the very direction in which I believe we should now be headed — the direction of furnishing adequate educational opportunities for Alaskan youth and of making the Territory increasingly self-reliant and self-dependent. I believe it is one of practical usefulness, completely integrated with the needs of the Territory."

What a long way this institution has come since the cornerstone was laid on July 4, 1915, at College, three miles west of Fairbanks! On September 18, 1922, it opened for instruction — as the "Alaska Agricultural College and School of Mines," with six students and a main building. On July 1, 1935, it became the University of Alaska. Not only is it a fully accredited member of the Association of American Colleges, and of the Association of Land Grant Colleges and Universities, it is the "farthest north university in the world."

Today it has a regular student enrollment of 400, with 800 additional students taking special and extension courses in eight Alaskan communities. It has the country's northernmost Agricultural Extension Service and Experimental Stations; one close by in the Tanana Valley, another in famed Matanuska Valley, and one for fur farming, at Petersburg. It also has the nation's only Geophysical Institute, with a fine new Laboratory Building. A Magnetic Observatory and Seismograph are also based on the campus.

Long ago General Billy Mitchell said of Alaska: "He who holds Alaska holds the world." And Vilhjalmur Stefansson, Arctic explorer, called it "the crossroads of all northern lands."

In Alaska, our "Last Frontier," the small but excellent university under its dynamic leadership seems destined to play an important role. More and more does the nation need to know about Alaska's resources, its history, its peoples, its problems, its future possibilities — and its dangers, of which there are many.

Such a university, although small, required an outstanding faculty to have become such an integral factor in the Territory. It has such a faculty. Dr. Charles E. Bunnell, the president emeritus, is the "grand old man" of whom it has been said: "The University of Alaska owes its birth and continuation largely to the vision, initiative and tireless energy of one man, the first president, who is responsible for its outstanding growth and character."

Upon Dr. Bunnell's retirement, two years ago, Dr. Terris Moore, Harvard Ph.D. and president of the Boston Museum of Science, became president. Dr.

Courses in wildlife management train for careers in wildlife conservation and propagation. Students are studying animals in a disease control project.

PHOTOGRAPH BY JOHN SIGLER

Moore has been a university professor, has had a successful business career, and is deeply interested in Alaska and its future. Recently he and Mrs. Moore made an aerial tour of the Territory in their own plane.

Carefully selected from various parts of the United States, the members of the University Staff have been chosen for their individual ability to carry on research and work under conditions that Alaska has to offer. Among them are a liberal sprinkling of Ph.D.'s and professors from Harvard, Yale, Columbia, Cornell, and the Universities of California, Washington, Colorado, Illinois, Missouri. It is a cosmopolitan faculty of wide experience.

With a campus of 2250 acres (not all in use at present) the university is looking toward the future. Besides its 300-acre experimental station close by, the campus supports the headquarters of the Agricultural Extension Service, the Carnegie Institution Laboratory, a Territorial Assay Office, an exceptionally good library for its size (20,000 bound volumes and 20,000 bulletins and pamphlets), and a museum of some 75,000 interesting and valuable specimens. Of course, there is not space for all of these to be on display. Research in archeology, dendrochronology and paleontology is being continued at the University with the help of the American Museum of Natural History, and financial assistance from Dr. Childs Frick of the Frick Laboratories. Always handicapped by inadequate funds and lack of buildings, the University has struggled on, for, as Governor Gruening said, he "knew no one who could make a dollar go as far as Dr. Bunnell"

Alaska, with its 586,400 square miles, has roughly one-fifth the area of continental United States. Its long and deeply indented coastline, extending southeasterly toward the States, the island chain of the Aleutians extending far southwestwardly into the North Pacific, the Bering Sea and Arctic Coasts make an estimated 25,000 miles of coast. Thus it is easy to understand how fisheries and sealing are its most important industries. In a recent year the salmon cannery output alone was worth $85,000,000, a significant figure compared with the $7,200,000 paid for the Territory back in 1867, when the purchase was bitterly condemned as "Seward's Folly" and became a political issue.

It is a tragic reflection on our government throughout these long years that almost none of this wealth from Alaska's natural resources helps to develop the country. Much of this can be corrected, loyal Alaskans believe, if the Territory can gain Statehood.

The University, situated in the "golden heart of Alaska," is today reaching out to all parts of the Territory and into all phases of life, building up the country, the homes, the farms, the industries. It is interested in the wildlife, the natural resources and their development and protection.

After its purchase by the United States, Alaska was for years a "forgotten land," pretty much ignored by our government. The Gold Rush "put it on the map," later the "Silver Horde" surpassed gold in wealth-producing — and still does. Although in earlier days, exploitation was the dominant aim, President Moore, and others with Alaska's best welfare at heart, think that Alaska is now in a transition period. There are now many third generation Alaskans to whom the country is home, where they were born and expect to live out their lives. They are much interested in renewable and enduring activities in a development program, and they insist very vehemently that Alaska's wealth should be kept at home.

In the past there were too glowing accounts of agricultural possibilities in Alaska, as there have been of its abundance of wildlife. Earlier and too optimistic reports estimated that 41,600,000 acres could be tilled; and an additional 22,400,000 acres could be pastured. Today's more sober estimates place the figure far below that. Summer range and pasture *are* extensive, *but* limited supplies of grain and harvested forage for winter feeding constitute a serious obstacle to livestock pro-

PHOTOGRAPH BY JOHN SIGLER

Biology at the University places special emphasis on Alaskan life. Here the class is studying the Alaskan oyster.

duction. Hay is difficult to cure in the humid atmosphere, and the long feeding period, labor, and overhead costs make winter feeding unprofitable. Some point out that where range might be adequate for grazing stock for a few months, there is usually not enough associated land suitable for growing feed crops to carry animals over winter. Others believe it is possible that much beef cattle could be raised on the pasturage available, then fed on storage crops until late fall and slaughtered for local consumption.

Dr. Basil Bensin, former agronomist of the Agricultural Experiment Station at the University, has done some outstanding experiments with acclimatization of grains, grasses and legumes introduced from Siberia, Finland, Sweden, Norway, northern Canada and our own northwestern states. He has also done some experimenting with hybrids and has developed excellent pasturage for the "northernmost dairies." Another expert in this field is Dr. C. W. Gasser, who has done much with hybrids of barley and wheat varieties. In the Tanana region the Siberian wheat grows excellently and Siberian alfalfa is said to be "kill-proof in any weather." Field peas, oats, and vetch provide silage.

In much of Alaska *permafrost* is a problem. Most of the land north of the Alaska Range has a soil that, except at the surface, remains perpetually frozen to a depth of one to several hundred feet and never thaws out during the summer. This is *not* from the current winter freezing, but is a hold-over from the Ice Age. It can be thawed, and once thawed does not again freeze beyond the winter surface freezing. But thawing is an expensive process. Too, clearing the land in Alaska is expensive, and all this has a bearing on agriculture. Practically all soils, whether frozen or not, are too cold for root growth at depths of a foot or two below the surface.

However, many plants do remarkably well. Around Fairbanks flowers were glorious; we saw delphiniums that reached to the eaves of one-story houses. Around Circle Springs cabbages sometimes grow so large that one will fill a wheelbarrow. In fact, all the so-called "Crucifers" do well; in many fields and gardens in the Valley we saw cabbages, cauliflower, broccoli, brussels sprouts, kale, kohlrabi, Chinese cabbage, mustard, turnip, rutabaga. Such frost-hardy, cool-season vegetables were so abundant that they reminded me of Walter Hines Page's comment that "England has only five vegetables, and three of those are cabbages."

Potatoes constitute the main "cash crop" in the Tanana Valley, and, in 1949, some 1100 tons were grown. Although the growing season is short, plants grow fast because the summer daylight is almost continuous. Unfortunately, tomatoes and corn do not mature, although tomatoes are often raised in greenhouses. Many homes have small greenhouses, and both hot and cold frames are popular with home gardeners.

Strawberries and red raspberries do exceptionally well, as do the native blueberries and cranberries. But even the hardiest apples and plums fail to produce fruit, the trees usually dying in a year or two.

To the outside world Matanuska Valley is better known, and we found its famed project interesting, although we were told that few of the original "homesteaders" are there today. Those that did remain seem to be doing well. Still another favorable valley is near Homer, in the Kenai Penninsula.

While the University emphasizes mining, agriculture and engineering, it is alert to many other educational needs. Although so near Russia and so vulnerable to attack, the authorities realize that now, more than ever before, it is important to know as much as possible about Russia, its history, its people, its language, its culture, its problems. So courses bearing upon all these subjects are offered.

As the Governor said, in one of his recent reports: "Just across Bering Strait, in eastern Siberia, the Soviets are promoting agriculture with great energy, with experiment stations every hundred miles, and are pushing the limits of agriculture farther and farther

north, integrating agriculture with mining and new industries." (Yet in the face of that it has been impossible to get Congress to appropriate adequately for the promotion and development of Alaskan agriculture.) Russia is reported to be devoting serious attention to the domestication of the moose, both as a source of food and as a draft animal; of the yak, which is used as a beast of burden and gives rich milk, and of other hoofed mammals.

Not only does such work and study contribute to our knowledge of Russian efforts and progress in an environment similar to that of Alaska, but we realize how thoroughly Russia is going into every phase of her development. Granted, she is doing it ruthlessly, much of it doubtless with slave labor, but, *she is leaving no stone unturned in the development of her own Arctic lands!* It might be wisdom for us to pay more attention to our own!

More and more the University is paying serious attention to Alaska's future in fish and game. As its Wildlife Research Unit points out, people in the States get the impression that the supply is supposedly everywhere and limitless. Most of the land in Alaska is of the greatest value in producing wildlife, but great changes have been made in the numbers of our big game and fish — the herds of caribou, which twenty-five years ago were estimated in millions, are now down to about 160,000. Fires which have burned a large part of the interior have often destroyed the lichens on which the caribou depend and it takes decades for this growth to develop again. And along with changes in habitat have come big increases in the numbers of hunters. The numbers of non-resident hunting and fishing licenses issued in the Territory have increased sixty-fold since the late twenties, and at the same time resident ones have increased seven times since 1936. In a matter of hours parties of hunters can fly in from the States by plane, for a "Big Bag."

University and Wildlife biologists are making surveys of the caribou, moose, sheep and goat numbers and ranges, so they may know if these species are increasing or decreasing too rapidly, and to determine whether it is worthwhile to try to manage Alaska's game, furbearers and fish on a sustained yield basis. Furs normally produce the Territory's third largest source of income, and it is estimated that Alaska's game birds and mammals are producing 4½ million pounds of meat annually. Too, it is important to recognize the fact that wildlife is the chief source of food and clothing for many; that without it they could not exist. Including families of native owners, more than 14,000 persons depend on introduced reindeer as an essential source of food and clothing.

In such studies the University is endeavoring to determine "what harvest seasons would be best from the standpoints of pelt size and quality, winter losses from natural causes, interference with reproduction and allowable take? With most of the mammals we need more information on their reproductive habits *under Alaskan conditions*. With the short growing season this rate is probably slower than farther south, but we do not know whether this is true or not."

We know that large numbers of waterfowl are produced in Alaska, but just where, and how many? We need more information. Banding a good supply of birds from the interior and Arctic regions would add to our information of where they go on their southern migration.

"It isn't," said one of the University spokesman, "the quantity of game that makes Alaska famous — some single states have more head of big game than the Territory. But what state has the big brown bear, moose the size of the Kenai, caribou, reindeer, or four-pound grayling in crystal-clear mountain streams? *Alaska cannot lose this unique heritage!*"

And here seems as good a place as any to say that in one respect, at least Alaska is far ahead of the States in that the Territory took a forward-looking step in enacting a law *controlling outdoor advertising*, thus forestalling the defacing of its scenic highways by billboards.

Crossroads of all Northern Lands! In and around these Crossroads Alaska's University is surely destined to play a more and more important role, especially now with the new Geophysical Institute, the largest in the world, complete with some of the finest equipment to advance knowledge in the broad field of the physics of the earth, especially that part related to the Arctic, the stratosphere and regions beyond, light of the night sky and aurora, ozone content of the atmosphere, meteorological investigations, radio waves, scattering of light along a searchlight beam and so on. Sounds rather Einsteinish, yet what an important part it may play in aerial warfare and the saving of human lives!

And so the University seems well on the road to a successful future. Governor Gruening hopes that, in time, there may be a southern branch of the University, situated around Ketchikan, possibly. Distances in Alaska are so great, transportation costly, and a southern branch would provide training in subjects of great importance to the Territory for which instruction cannot suitably be given at Fairbanks — practical training in the fields of fisheries, forestry, navigation, marine activities and other subjects closely related to the sea and not now provided, and which cannot be served by the present plant.

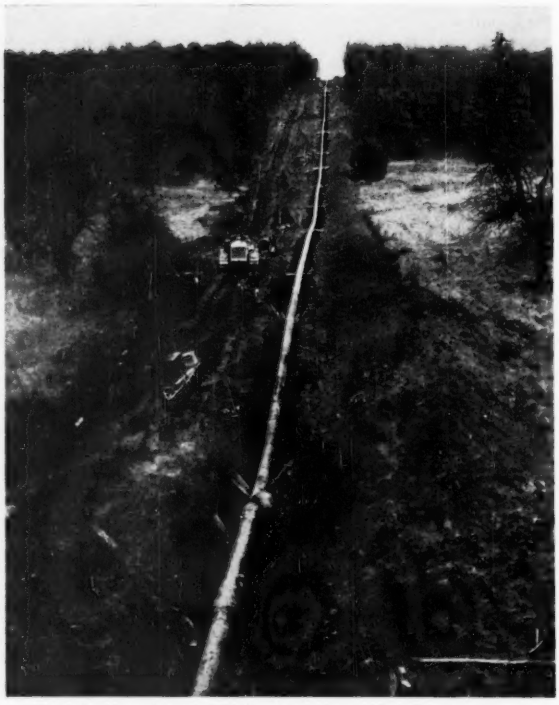
But the University is by no means all work and no play. Sports are important there as elsewhere, and where California has its *Rose Bowl*, Louisiana its *Sugar Bowl*, Alaska has its annual football classic in its *Ice Bowl*. It also has varsity basketball and intramural sports, volley ball, ice hockey, skiing and snowshoe races, speed skating, boxing, wrestling; and, in spring, track, field events, tennis, archery, hiking.

The University of Alaska on the Air has weekly programs; it has its own publications; there is a Camera Club. And, of course, dances. It even has a Sadie Hawkins day! (Continued on page 272)

Wild Spirits

By EUGENE W. NELSON

Photographs courtesy Jones and Laughlin Steel Corporation



Up hill and down dale, the natural gas pipeline does violence to the landscape as it is laid to carry the wild spirits of the earth to the consumer. This pipe, of course, will be covered into its ditch for protection.

In GREECE, some score or more of centuries ago, a herdsman was tending his goats. Gradually he began to realize that some of his four-footed charges wandered about in an unusual manner whenever they came to a certain spot. Investigating their pecualir behavior, he himself became affected by something rising from the ground. He ran to his village and told his neighbors. Hurrying to the spot, they all had the same experience. They became talkative and light-headed. They acted queerly and their conversation was disconnected and hard to understand.

The villagers agreed that they were in the presence of a supernatural agency, and that a god was living there. Later they appointed a priestess to keep in touch with this god, and built a temple where people might come for advice. Thus was created the famous Oracle of Delphi.

Of course, we know now that the "spirit" of the god who dwelt at Delphi was a seepage of natural gas, and that, by smelling it, the priestess would pass into a sort of coma, during which time she would babble incoherently. Priests would then translate these babblings in whatever way they thought best, and, you may be sure, always to their own profit. The great treasure accumulated at Delphi in the passing years was the first fortune — but not the last — made from natural gas.

The Chinese are credited with a good many "firsts," for which no credit is due them. As for the first use of natural gas, however, they seem really to deserve the credit. They were certainly superstitious, too, but apparently they did not let their fears blind them to the useful nature of this particular earth treasure. Plenty of evidence has been found to prove that, many centuries ago, the Chinese obtained natural gas from wells 2000 feet deep. They transported the gas from the wells through crude pipe lines made of bamboo or animal intestines, and burned it for cooking, home heating, and even for evaporating salt brine.

Gas wells were known in Japan as early as 615 A.D. Natural gas was also known in British India, Persia, and some European countries. At an early date, Genoa was lighted by gas brought from the wells of Anniamo, in Parma. Between superstition, ignorance, and the difficulties of producing and transporting gas, it has taken us many centuries to tame the "wild spirit" of prehistoric times and put it to work. It was not until 1807 that London had its first public street lighting with gas. The United States followed suit in 1816, Baltimore being the city that took this modernizing step.

Despite the fact that natural gas proved to be the almost ideal fuel for many purposes, as late as 1880 there was still strong opposition to its use. According to records, this opposition was based on the popular belief that the entire earth was saturated with gas, and that in case of a fire the world would literally blow up!

Much geological study has pretty well dispelled that notion, but the true origin of natural gas is still not known certainly and is a much debated subject. The theory most generally accepted is that the gas was formed by a chemical action in the earth upon marine organisms buried in the sands ages ago along what was then seashore. Heat and pressure of the overlying earth contributed largely to the result.

As the ages succeeded each other, these sands settled very slowly and were over-laid with other deposits and sediments hundreds of feet deep. As this overburden increased, the pressure and heat solidified some of the

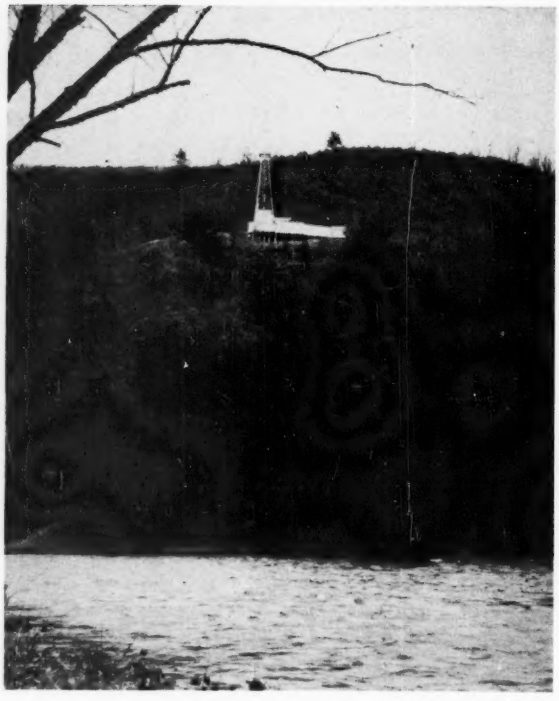
This is not a scene of U.S. Army Engineers crossing a Korean river but drillers cutting into a river bottom preparatory to blasting a trench in which the natural gas pipe line will be laid. This is difficult and exacting work. Below, the caterpillar tractor proves its worth as it snakes a truck holding heavy sections of pipe up steep grades. The pipes are dropped from the truck, one after another. If the wire cable should snap workmen and truck would be in serious danger.

sand and other materials into rocky formations. In many cases, in later years, these areas were again raised and became land surfaces, which still later were partly eroded and washed away. And later yet, some of these areas again settled under water and other like deposits were formed, containing similar organisms that formed another layer of gas or oil sand.

These alternate raisings and submersions were, in some cases, repeated several times over a period of millions of years, so that we now find, upon drilling the same area, natural gas in several deposits at different depths. The general theory with respect to the origin of the gas answers many questions, but it must be admitted that it leaves some other questions without satisfactory answers. It is a fact, however, that gas is found under only a small portion of the earth's total surface.

It might be well to explain right here that the so-called "gas-sands" of which geologists speak are not sands at all. Instead, they are usually porous rocks, sandstone, or broken limestone. Inside tiny cells in the rock, invisible to the naked eye, the gas is stored. Each cell connects with the ones next to it. These sands are covered by a layer of rock called a "cap rock" and are usually under-laid by another layer of the same kind. When the cap rock is pierced or broken anywhere, pressure forces the gas out of its cells, through the porous openings, and so into whatever hole has been made in the cap rock.

Certain types of "sands" are more productive of gas than others, although drillers often find sands, exactly



In the wilds of Pennsylvania stands this typical gas well, which tames the wild spirits.

similar to those producing large quantities of gas, that have no gas at all. Gas is present only if the cap rock is shaped so as to form a dome or an inverted container that seals in the supply. Much of the gas that was generated in the past eons has escaped because the overlying rock did not provide this dome. Therefore, only a small percentage of the normal, gas-bearing sands now contain gas. Of the three million square miles in the United States, less than twelve thousand have been found to contain gas, and, even in these areas, it is not unusual to drill into the sand and find no gas.

By studying the characteristics of rock formations where gas has been found, geologists are able, by locating similar geological structures, to indicate probable productive areas. Thus it is possible to eliminate a lot of hit-and-miss prospecting. Drilling, however, is still the only known method of definitely determining whether or not an area will produce gas.

Drilling for gas is rough, heavy work. In some parts of the country where the rock is soft, a rotary drill, which acts something like a brace and bit, is used to tap the precious gas formations. In most places, however, drilling is by the "cable method." This calls for a seven-foot-long steel "bit" — or drill — to be fixed to a 42-foot-long steel stem. Above the stem are heavy "jars" to loosen the tools if they should stick in the rock. The whole drilling tool (or "string of tools" as it is often called) is some 65 feet long. This is fastened to several thousand feet of wire rope. A powerful engine then raises and lowers the tool in the hole, thumping the end of the hard steel bit against the rock, then lifting the whole string of tools up for another smash.

At regular intervals, as the hole progresses, sections of pipe are inserted in the hole to keep the sides from caving in. Thus, by relentless raising and lowering of the heavy steel drilling tool on the bottom of the hole, the well is slowly deepened. To remove the crushed rock from the hole, the drilling tool is hoisted out periodically and a "baling"device lowered into it. Water is then pumped into the hole. It mixes with the loose earth and pulverized rock, forming a watery mud. The "baler" brings the mud to the surface. Back goes the drilling tool again. This process is repeated over and over during the two twelve-hour shifts for six days out of every week, at most wells.

Many natural gas wells are between 5000 and 6000 feet deep; some even deeper. When the cap rock is finally pierced, the gas immediately starts to escape through the opening. Because of its tremendous pressure, the gas must have a clear means of escape. If anything restricts its flow, the gas will freeze, sometimes turning the water in it to ice, which, in turn, clogs the pipe lines.

Even more difficult than drilling is the problem of transporting the natural gas from the place where it is found to the places where it is to be used. Although drilling for gas is much like drilling for oil, the transportation problems are entirely different. The oil man can ship his product by pipe line, tanker, tank car, barge, in barrels, or in any one of a number of other ways; the gas producer has only one mode of shipment — pipe lines.

Laying pipe lines for natural gas is an even rougher chore than drilling. The pipe-stringing crews are rugged men who use powerful machines, heavy steel pipe and thick wire rope. With mobile cranes they unload the large sections of pipe from railroad cars onto trucks. Powerful tractors with winches pull the trucks through mire, muck, and up precipitous hillsides. Pipe sections are unloaded along the pipe line "right of way." The "stringing crew" pioneers the way for the "laying crew," laying down the pipe where the other crew can get at it easily. The laying crew digs a continuous ditch and puts the pipe four feet or more underground. Operating seven days a week the year round, over mountains, deserts, and through swamps, the crews keep the pipe line always moving ahead.

Laying the pipe line across a river calls for a slight change in the general (Continued on page 272)

The Italian Garden in the International Friendship Gardens. Classic columns take one back to one of the formal gardens of Italy. Below is the Theater of Nations, one of the two outdoor theaters in the Gardens. The audience is seated across a small lake in which the reflections of the actors and stage settings can be seen. Audiences of 5000 can be accommodated for the fine series of musical presentations put on each summer.

International Friendship Gardens

By MARGARET WHITTEMORE

Photographs courtesy of Stauffer Brothers

IN THE heart of the Lake Michigan dunes country of northern Indiana are the enchanting International Friendship Gardens, dedicated to world unity and understanding. This flower-lover's paradise, covering more than one hundred acres, hemmed in by wooded hills, and traversed by Trail Creek, is one of the most extensive plantings of flowers, shrubbery and trees to be found anywhere in the world.

The originators of this philanthropic enterprise are two brothers of Hammond, Indiana, — Virgil and Joseph Stauffer — one a professional musician, and the other an engineer. Ever since boyhood they had dreamed of making a huge floral beauty spot and exhibition area. With this in mind, they had visited many famous gardens, both public and private, in Europe and America. The Century of Progress Exposition in Chicago in 1933 and 1934 gave them an opportunity to carry out their idea on a small scale. There they planted the favorite flowers of three hundred of the world's notable personages — kings, queens, presidents, musicians, artists, scientists, and others — representatives of fifty nations being included in this international display.

Encouraged by the success of their Chicago venture, the Stauffer brothers began searching for a suitable site for a permanent garden dedicated to friends of flowers the world over. An ideal location was found just fifty-two miles from Chicago, adjoining Michigan City, Indiana, where Pottawatomie Indians formerly had their camping ground. The land, which had been left in almost its virgin state, is now leased for a period of

The Little Symphony Theater is designed for musicales and smaller attractions and has a grass-covered stage large enough to accommodate a 100-piece orchestra.

two hundred years.

Working early and late, the Stauffers, through their own efforts, began clearing the valley of its dense underbrush. City officials provided WPA labor assistance when possible. The Alaskan Building from the Chicago Exposition was obtained from the federal government and reconstructed in the center of the garden area. This became the headquarters, as well as living quarters, for the brothers, both of whom are bachelors. Here they can supervise the many details of development of the gardens, as the project expands.

Plants, seeds and young shrubs have been donated by countries all over the world, eager to be represented in the Friendship Gardens. From Holland have come more than 225,000 bulbs, making one of the outstanding tulip displays in America. The President of Guatemala sent, by airplane, rare orchids and other flora valued at thousands of dollars.

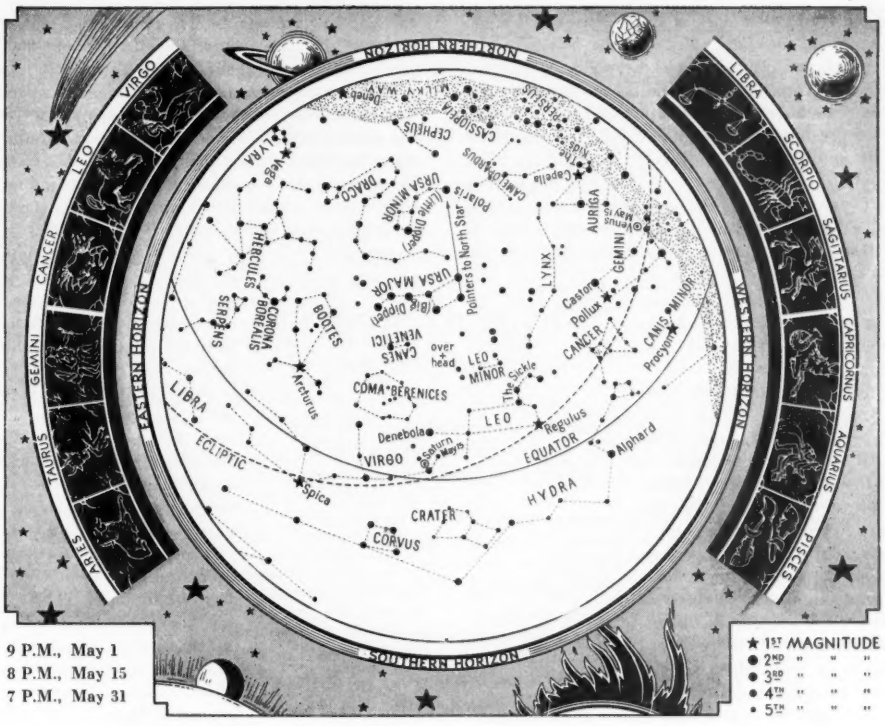
The Gardens are open to the public the first Sunday in May with "Tulips on Parade," and continue through the summer with displays of many thousands of roses, oriental poppies, iris, peonies, lilies, phlox, gladioli, zinnias, hibiscus, dahlias, marigolds, and chrysanthemums, providing a perpetual flower show, finally ending with brilliant autumn foliage. One may wander for hours among trees and flowers, finding a new and delightful vista at every turn. Song birds of great variety are attracted by the quiet seclusion of gardens and wooded vales.

Typical plantings from foreign lands lie in close proximity to each other. The first of the Gardens of the Nations to be completed was the Italian Garden, with tall vases and statuary. Reflected in a crystal clear pool are classic columns — replicas from the Roman Forum. The Grecian Garden, precise and formal in design, is planted solidly with evergreens and clipped hedges. In contrast, the English Garden is open and rambling. The French Garden, with its maze of clipped hedges, features flaming Cardinal Richelieu roses. There are Swedish, Turkish, German, Chinese, Canadian, and Polish Gardens, besides many others — each an individual expression of international amity. As each national garden is completed, suitable dedication ceremonies are planned. It is hoped in time to interest every nation in contributing something to this unique project. The response, thus far, appears to make this possible.

During World War II, the President of Poland wrote an appreciative and touching letter, stating that the Polish Garden would keep the memory of their homeland alive in the breasts of American Poles. Avila Comancho, President of Mexico, said, "I believe the International Friendship Gardens, in their philanthropic work, constitute a fine symbol and an excellent example of the ideal that free countries, peaceful and industrious, desire to see realized in the very near future." From Peter Frazer, Prime Minister of New Zealand. came the following message: "In the days that are to come. . .may International Friendship Gardens flourish as a memorial to the peace and goodwill among all peoples of the world." Other national leaders have sent similar words of appreciation.

Provision has been made in a delightful manner for cultural entertainment. Two outdoor theaters have been built amid the trees and shrubs. The Little Symphony Theater, for musicales and smaller attractions. has a grass-covered stage large enough to accommodate a 100-piece orchestra, while an audience of one thousand may be seated on the lawn. Rows of evergreens and slender Lombardy poplars, like pipes of an organ, form the background of the stage.

The site for the Theater of Nations, sometimes referred to as "the Salzburg of America," was chosen directly in front of a wooded hill, thus forming a natural amphitheater. The grassy stage, bordered by weeping willows, is built on an island in a small lake, so that the audience, seated on the opposite shore, may enjoy the reflections of actors and stage settings in the mirrored lagoon below. Every summer the finest operatic, choral, orchestral, and legitimate stage productions attract capacity crowds of 5000 persons, many coming from the summer resorts lining the eastern shores of Lake Michigan. Yearly the fame of these gardens spreads and the brothers' vision is nearing its goal.



To use this map hold it before you in a vertical position and turn it until the direction of the compass that you wish to face is at the bottom. Then, below the center of the map, which is the point overhead, will be seen the constellations visible in that part of the heavens. It will not be necessary to turn the map if the direction faced is south.

How Hot Are the Stars?

By ISABEL M. LEWIS

STARS vary in the temperature of their radiating surfaces with their colors, and with the wavelengths of the most intense radiations in their spectra. There are certain laws of radiation by means of which the temperature of the radiating surface of a star can be calculated, after the quality and quantity of the star's radiation have been observed. One method of measuring the temperature is by means of a thermocouple, an electrical device for measuring differences in the intensity of radiation of different wavelengths in the spectrum of a star. There are a number of other ways in which it may be done.

There has been found to be a great range of temperature, from the coolest to the hottest stars, increasing with the change in spectral type. This range is from the red-type stars, through the orange, yellow, yellowish-white, and white, to the most intensely hot of all stars, the blue-white stars. The coolest stars have temperatures of 2000 to 3000 degrees Absolute, in which the zero of the scale is 273 degrees below zero, Centigrade, or 492 degrees below zero, Fahrenheit, and the degrees are the same as in the Centigrade scale. The temperature on the Fahrenheit scale that corresponds to 2000 degrees Absolute would be approximately 3140 degrees. These are temperatures so low that they can be produced in electric furnaces in our laboratories. Stars with such temperatures are the red stars, both giants and dwarfs, and their temperatures are low enough to allow the formation of the spectral bands of neutral molecules of the refractory oxides of titanium and zirconium, or carbon compounds. They also show in their spectra lines of neutral atoms of iron, calcium, sodium and other elements. Lines of hydrogen, which is the most abundant of all elements, appear also in

these red stars, as it does in the spectra of all stars. Red stars are classified chiefly as the M-type stars, both dwarfs and giants; and as carbon, or N-type, because of the prominence of the carbon bands in the spectra of such stars. It has been found that the effective temperatures of the giant M-type stars are lower than those of dwarfs of the same spectral class. The atmospheres of the giant stars are less dense than those of the dwarf red stars, and the characteristics of the spectrum of the star depend upon the density as well as the temperature of the star. This applies to the yellow giant stars as well as to the red giants. The red stars Betelgeuze and Antares are both super-giant stars of spectral class M.

Arcturus, the orange-colored star of first magnitude that is so easily recognized in the kite-shaped constellation of Bootes throughout the summer months, belongs to the spectral type of stars known as K-type stars. Like all the other different spectral types of stars they have their characteristic pattern of spectral lines by which they can be distinguished from stars of other types, as well as by their distinctive color and temperature. In these stars the titanium oxide bands finally disappear from the spectrum of the star as the temperature grows hotter. Lines of the metallic elements, however, are very strong in these stars. The intensity of radiation is still greatest in the red end of the spectrum, and, although on the whole stars of this type are a thousand degrees Centigrade, or hotter than the M-type stars, they are still classed as "cool" stars.

Stars of the same type as our own sun are known as G-type stars. They are the yellow stars, such as Capella and Alpha Centauri. Many lines of neutral metals appear in the spectra of these stars; lines of sodium, iron magnesium and many others are conspicuous. The lines of hydrogen, which are so abundantly present in all stars, are becoming stronger in these stars because more hydrogen atoms are becoming ionized with the increased temperature. The lines of ionized calcium appear in the spectra of yellow stars. An atom of an element is said to be singly ionized when one electron has been removed. At still hotter temperatures a second electron may be lost and the element is doubly ionized. Under the intense heat of the hottest stars atoms may be triply ionized, as well as singly or doubly ionized, and the electrical excitation at the radiating surface of the star may be very great.

The temperature of our own sun, which may be taken as typical of the *average* star of this type, not of the giants of the class such as Capella, is about 6000 degrees Absolute, or about 10,300, Fahrenheit. It has this temperature only near the center of the solar disk, where the radiation passes most directly to us through the shortest path in the solar atmosphere. Radiations that come from around the edges of the disk have the longest path through the solar atmosphere and are the least intense of all. The temperature from these outlying portions of the photosphere is about 1000 degrees Centigrade cooler than radiations from the center of the disk. Sunspot areas on the sun are also much cooler than other portions of the surface. The temperature of the umbra, or darkest center of a sunspot area, is about 4500 degrees Absolute, (4227 Centigrade). In the F-type stars, the spectral type of stars next higher in the ascending scale of temperature to the G-type or Solar-type stars, including such stars as the giant Canopus, and Procyon, the effective surface temperature is about 6500-7000 degrees Absolute. These stars are yellowish-white in color, and in their spectra the ionized calcium lines are conspicuous. The lines of metallic elements are less prominent than in the stars of lower temperature, but intensity of the hydrogen lines is increasing.

In the stars of type A the color is white and they are known as Sirian or Hydrogen stars. Sirius is the most illustrious star of this type, although Vega is also a white hydrogen star. Temperatures of stars of this type range from about 8000 to 10,500 degrees Absolute. The lines of hydrogen are intense in these stars, and this is the most common type of stars, after the K-type stars, which are the most numerous of all. The neutral lines of metals begin to fade out in the F-type stars, and metallic lines are disappearing in the hotter stars because they are now losing electrons and becoming ionized, and lines of many of the ionized metals lie in the ultraviolet part of the spectrum and so are invisible. As the star temperatures get higher the star spectra become more simple for this reason.

The Helium, Type B, or Orion stars, as they are also called, because there are so many of them in that constellation, are the bluish-white stars. These stars are very brilliant, hot, and massive. Rigel is the best-known of all of the Helium stars. The star Beta, in the Southern Cross, is also a star of this type. Helium lines are prominent in the spectra of these stars. They lie mostly in or near the Milky Way. Hydrogen lines are not as conspicuous in (Continued on page 272)

Eyes to Space

By DANIEL SMYTHE

Only a few suns can we see
In our galactic Island drawn:
Man may look up the faint dim tree
Of space that starlight shines upon.

And over them in vaster scope,
Assisted visions pierce the wall.
We swing the giant telescope
That we may reach the almost all.

But galaxies a billion years
In distance make our small means fail.
We look through swarms at what appears
So far that we cannot unveil.

A speck of universal dust,
Our earth with its faint star is lost —
But on we go because we must,
Commanded by unchanging law.

The School Page

By E. LAURENCE PALMER

Professor of Nature and Science Education, Cornell University, and Director of Nature Education, The American Nature Association

SCENTS AND FLAVORS IN SCHOOL

THE study of scents and flavors might be approached from the viewpoint of the connoiseur in school, but few teachers would enthuse over such an approach. Many of them would prefer to have a lesson plan on how to use this material. We do not elect to write such a plan, but it seems reasonable to suggest some orthodox pedagogic angles that might have some merit.

One might say that one should not waste time on the study of perfumes, and on things that increase the palatability of foods, when the school program calls for geography, writing, science, literature and the social sciences, including history and economics. Fortunately, scents and flavors have left their mark on each of these parts of the school program. Fortunately, also, some children are more interested in cinnamon rolls and spiced cookies than they are in tropical geography. Why not recognize this fact and build a geography lesson on the favorite flavorings that appeal to the tastes of the class? The accompanying insert gives the geographic information necessary to do this sort of thing. If the chart material in such earlier inserts as the one dealing with herbs is brought into use, the lesson may be further enriched. Any teacher will recognize in this situation the opportunity to make display charts showing the parts of the world from which well known flavorings and fragrances come to us through the grocery and drug store. The trade routes through which these materials passed may be pointed out, and the races of men that have been involved, in all probability, may be considered.

The culture of the exotic plants considered may suggest other school activities, and while some effort should, of course, be made to study the raising of those plants that grow locally, and that are helpful in satisfying our senses of smell and taste, nevertheless there will be teachers who feel that they must consider activities in remote areas. What kinds of draft animals are to be found where okra, dill, papaya, guava, olives and gardenias are native? To what extent have these plants moved over the earth from their places of origin?

The social sciences come in for their share, as we have in part already suggested, but world trade has frequently been built on transporting great distances substances that have great value, little weight, and small volume. What is the significance of the term "lime-juicer" in history? What prosperity and what slavery have come to parts of the world where spices are produced most efficiently? How has this helped shape the economic and political world in the days of empire growth, and in what ways will the changed status, for example, of the British and Dutch empires, have on the future happiness of peoples living in the colonies and in the homeland of the empires? Some of these questions can be answered and some cannot, but opinions can and should be formed by any who may ever be charged with voting on world issues. How has industry helped and harmed the trade in scents and flavorings? How has science helped or interfered? To what extent are we as citizens influenced to like this or that fragrance or scent by the press, the stage, the radio and by what the Joneses think of us? Take any popular weekly magazine that has abundant illustrations and blatant advertising and learn how effectively the real or imagined merits of scents and flavorings are advanced.

It may not always be kind, but it might be suggested that one examine the possibilities of making inferior or even spoiled foods attractive by the addition of certain flavorings. Similarly, one might suggest the camouflage possibilities in using scents to mask poor hygiene and sanitation. Some of the problems arising from this angle may be academic, others may be personal, and still others may involve moral responsibilities. In some cases, they may be incidental. In others, they may be critical from the health standpoint. They may even be of survival significance in certain instances. These lessons are brought home to some of us dynamically, while to others they may be more or less academic.

Sometimes, we learn our lesson, while at others we do not. I can still remember the restaurant keeper, in whose establishment I waited table as an undergraduate, who salvaged some soured mashed potatoes by the simple technique of adding some boiled onions. I left the place shortly after, for reasons of my own. The country store that supported my family's economy in the early days had many ways of salvaging crackers, maple sugar, dried apples and other products — ways I should prefer to forget — but I can bear witness that there were ways of making spoiled foods taste satisfactorily if you lived in the days when there are no pure food and drug act. Adding scents and flavorings are obviously means of making things taste and smell unnaturally. What is the ethics involved in the situation? How far can we go along this path of deception without making undue reservations?

Any good dictionary of references to the *Bible*, or to literature, will yield an abundance of suggestions showing how scents and flavorings have found a place in literature. The descriptive adjectives used by writers of advertisements, or of radio scripts, advancing this or that product that appeals to our taste or sense of smell, are legion. Make a little study of this to help increase the vocabulary of students. Let them try to write advertisements on a competitive basis to see who can best describe a substance having superior appeal to the senses with which we are here concerned. As a change of pace, it might be interesting to try similarly to describe substances offensive to these senses. Some of these descriptions have become hackneyed, even though they are absurdly senseless. What in the world, for example, could one mean by saying he has a dark-brown taste?

From the angle of the sciences, we have some interesting observations associated with the study of scents and flavorings. How can we explain the rapidity and extent to which a fragrance may extend without some understanding of the nature of air and the nature of volatile substances? We can have diffusion of odorless gases that are as far-reaching as may be the spreading of a fragrant smell. Can we not use our study of scents to help us understand diffusion of gases? We might even point out how harmful, odorless gases are deliberately scented so that leakages that might be dangerous may be detected.

Of course, any teacher of human physiology will recognize the implications of studying taste and the experimental mapping of the parts of the mouth in which there is some specialization in recognizing things that are bitter, sweet or sour. If you do not know what this story is, try it out in your own mouth by touching parts of the mouth with bits of cotton soaked in substances of these different taste qualities.

Some survey may be made of the development of synthetic scents and flavorings. This should be of particular interest to the teacher who is working with foods or to the teacher of chemistry. Incidentally, too, teachers working in these areas may wish to call attention to how scents and flavors change with the maturity of fruits or flowers, how these scents are extracted and preserved, why perfume bottles are corked and then covered with some substance through which the essence may not escape.

If one wished to lighten the approach to this subject, it might be illuminating to visit a series of perfume shops and compile a list of names used to intrigue buyers. Obviously, imagination must run riot in the minds of the originators of some of these names, and it may be even fun to imagine what they were imagining. I am still laughing over a list of names handed me on a wine list in a hotel in New Zealand a little more than a year ago. The names were just literally out of this hemisphere. Of course, I would not suggest that the study of wine lists should be required reading in our schools, but there is no reason why we should not suggest the study of any practice in which words are used to deceive. If there is any richer field of investigation, so far as this subject is concerned, I know of none that offers greater opportunity than is to be found in the study of scents and flavorings, in school or out.

Camera Trails

By
EDNA HOFFMAN EVANS

WHENEVER summer days and vacation times are just around the corner, as they are in May, I try to use something particularly appropriate as a "Camera Trails" subject. In past years I have written about nesting birds, about cloud effects, about flowers, about some special outdoor aspect. This year I am writing about brooks, and about the photographs one can make of a woodland stream or waterfall.

There is something fascinating about a brook, trickling between tree-shaded banks, gurgling over rocks and around large boulders. Small streams have always fascinated me. I can faintly remember loving one stream (we called it a "crick") in Ohio as an eight-year-old. There were a few minnows in it, a turtle or two, frogs that dived from the bank with pleasant splashes, soft green mosses, and mud that was smooth and squishy between the toes.

It was not much of a stream as I recall it; just a small trickle through the pasture, with a wider, knee-deep pool by a bend under some willows. And remembering willows, I wonder whether children still make willow whistles in Ohio in the springtime? And is it in March, April, or May that they make them?

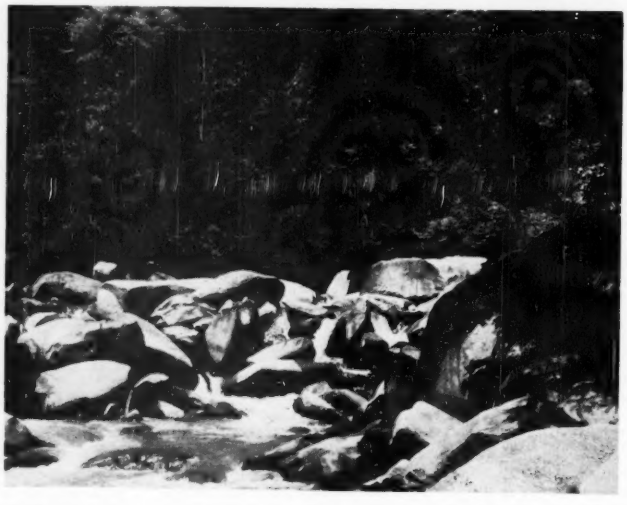
Probably that stream would not photograph worth anything — I have not seen it for more than a decade. It might have in the old days, but nice outdoor, woodsy places have a habit of changing, I have found, and the changes are generally not for the better. But I remember that small stream with pleasure and no amount of changes for the worse can alter my recollections.

Possibly those memories explain my liking for streams. At any rate I do like them and I photograph them whenever I get the opportunity. I am particularly partial to rocky streams, probably because my later childhood was spent in a State where rocks are virtually non-existent.

What should one look for in a stream, photographically speaking? First of all, a center of interest. That is of prime importance. Second, contrast. There must be a distinct difference in the values of foreground and background, otherwise the picture is nothing but a jumble of details, no one of which is capable of taking precedence over any other.

I am going to use two pictures to illustrate my points. One is an example of contrast with a central point of interest. The other shows a mass of detail with no one object on which the eye can rest or the interest can focus.

In this picture there is no center of interest, no contrast, no sharp highlights or deep shadows. Photographically it has nothing. Contrast it with the picture below with center of interest, contrasting detail in the foreground, and a background that blends harmoniously and does not detract from foreground.



So far as the originals of the two pictures are concerned, both are places of great natural beauty. There is peace and quiet in each of them. As for calmness and serenity, I really think the unphotographable place is more soul-satisfying than the more photogenic one. Sometimes it is impossible to capture the gentler beauties of Nature with a camera, just as it is impossible to imprison on a small piece of film the grandeur and majesty of vast stretches of landscape.

Study the two pictures. In the one with the rocks, there is a center of interest — the narrow white ribbon of water coming down among the stones and fanning out on the lower left of the picture. On the right the big boulder is in shadow; it does not detract, instead, its slope leads the eye to the more important detail in the center. On the left the broken mass of rocks give contrast to the more solid forms on the right.

In the background the heavy curtain of leaves provides a softer, deeper contrast for the highlights and the smooth hard surfaces of the foreground. No one detail stands out, not even the single trunk that shows. The eye sees it, but it is dark and so inconspicuous that it does not break the smooth harmony of the background.

I have wondered, from time to time as I have studied the photograph, whether a touch of sky would have helped in the

background. Ordinarily, I try to show a bit of sky above the treetops, especially in color pictures, by way of contrast. In this black-and-white picture, however, I think some sky would have detracted. It would have set up a smooth light area that would have drawn the eye away from the center of interest in the foreground. In this particular place it was impossible to maneuver any sky into the picture. And I have reached the conclusion that it was better thus.

In the other picture there is no center of interest. The eye moves restlessly from one jumble of detail to another. There is no contrast; there are no sharp highlights and no deep shadows. The larger tree trunks in the center background are not distinct enough, and certainly not important enough around which to build the picture. Neither is the ledge of rocks in the foreground.

The whole picture gives an odd impression. At first glance it appears to have been taken with the camera off center. It seems to slope to the right. But notice the tree trunks. They are vertical. It was not the camera, but the terrain itself, that was slanting. To the eye it was a restful, beautiful scene. To the camera it could offer nothing.

As for the technicalities of timing and exposure, they must be settled for each individual picture. In dealing with light along streams of this type, especially where the sunlight filters down through a screen of leaves, or where tall trees cast deep shadows, it is best to trust to a light meter. Noon is a bad time for photography. The sun, directly overhead, tends to give a flatness to shadows. Let the light come from an angle, even though that means a wait of several hours. After all, in beauty spots of that sort (barring the presence of mosquitoes or other biting insects) waiting should be a pleasure.

As for speed, there should be enough to allow for an unexpected puff of breeze, and slowness enough to show motion in the water. A shutter speed of 1/100th is sufficient, although light conditions may sometime make a speed of 1/50th, or even 1/25th, more desirable.

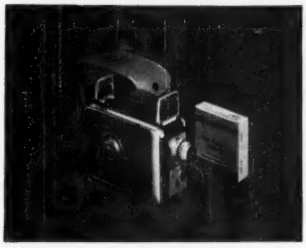
Deep shade and speckled sunlight are not so good, although the results can sometimes be interesting. Some streams trickle over stairways of shady rocks, or meander through deep woods. At no time of day is there any great amount of light on them. If you want a picture of this sort, you will have to take it as you find it, and make the best of what Nature has to offer.

PHOTO MURALS

Some time ago I wrote a section about photo murals that the camera fan can make for his home. Since then I have received an interesting booklet from Foto Murals of California, an organization that supplies photographic murals, in color, for home use.

The company offers its murals in two sizes. The muralettes are 40 by 60 inches (3 feet, 4 inches by 5 feet) and the murals are full picture window size, 90 by 180 inches (7 feet, 6 inches by 15 feet). The muralettes are equipped with an unpainted, mitered framework that simplifies installation and which can be painted any color desired in order to blend with the rest of the woodwork in the room. For use with large murals, some complementary wallpaper is recommended as a border.

Foto Murals is located at 672 South Lafayette Park Place, Los Angeles, California. Scenes are chiefly of California — Reflection Lake in Lassen Volcanic National Park, Cypress Point overlooking the Pacific, a rocky headland, windswept sand dunes from a drier region of the state, as well as some out-of-California scenes like



The new Brownie movie camera makes movie-taking a simple matter of adjusting the lens and pressing the button.

Jackson Lake with the Grand Tetons in the background, a serial pictorial map of the United States, and the Pilot's Highway which is an above-the-clouds sky scene available in either reddish tan or midnight blue.

The smaller muralettes are priced at $25. The larger murals are $39.50, plus installation. For a person who wants to bring the outdoors into his home, a letter to Foto Murals will bring full information. When writing, please mention "Camera Trails."

The Bolsey B-Special camera and extension rings make close-up work possible.

NEW EQUIPMENT

There are a number of new items I want to mention briefly in this section.

For photographers who want to do ex-

(Continued on page 274)

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WILD SPIRITS

(Continued from page 264)

technique. A trench — usually some five feet deep — has to be blasted in the river bottom and then cleaned out. Sections of steel pipe line are then bent to fit the contours of the trench and are welded together as they are pulled into position and sunk into the trench. The natural river deposits soon cover up the exposed pipe, thus protecting it somewhat from corrosion and accidental breakage.

In the past half century, the production and transportation of natural gas has become one of the truly giant industries of our country. Once a "wild spirit" — represented by the mysterious pillars of fire that issued from fissures in the earth to terrorize the natives — and then an incidental by-product of oil drilling, natural gas today has not only found its way into many homes, but, more and more, is replacing coal and fuel oil for numerous industrial purposes. Glass, ceramic, and brick plants; steel mills; cement plants; lead, enamel ware, and vitrified clay manufacturers; oil refineries, power plants, and all other industrial users within reach of existing or projected pipe lines provide ample illustration of the value of gas.

Natural gas, despite its importance for heating and cooking, represents something far more important to the modern industrial chemist. To the chemist, natural gas is a fabulous raw material with dazzling possibilities. It is a source of desirable atoms that can be reworked and restrung in such a way as to make the resulting molecules worth millions of dollars.

The famous oil chemist, Dr. Gustav Egloff, has gone on record as saying, "If one starts with natural gas, all the known synthetic products that man has developed in organic chemistry can be derived, and there are over 500,000 of them!"

Potentially, therefore, natural gas is the basis for a new industry that can make the coal tar industry look like very small potatoes indeed. For the gas which we now get from 37 of our forty-eight States can be converted into an incredible array of products — alcohol, plastics, rayons, perfumes, drugs, solvents, explosives, insecticides, and flavorings, to name a few.

Industrial chemists have already done all of these things, and they believe that, as yet, they have barely gotten their collective feet into the door. Yet some chemical texts still in use claim that natural gas is completely inert; that the molecules in natural gas can never be ripped apart and retailored into useful products. Now, chemists who have worked with it claim that it is "the most desirable chemical raw material the world has yet seen." And they visualize enormous new industries being built up around natural gas, industries that will supply new jobs, new wealth, and new products that may well revolutionize our everyday lives.

It may just happen that the next "age" will be the "Gas Age!" Stranger things have happened recently.

ALASKA UNIVERSITY

(Continued from page 261)

As for the feminine contingent, Dean Harry Brandt told me "The University is 'God's Gift to Girls' — for fifteen minutes after a girl arrives she is 'going steady.' " There are four or five men to every girl — and you can guess the results in a woman-hungry land.

Everywhere I went in Alaska, and of everyone I interviewed, I asked the same question: "What does Alaska need most?"

In general the answers were much the same. "Alaska needs people. It needs basic industries, especially some year-round ones. It needs housing. And it needs more voice in running its own affairs. *Alaska needs Statehood!*"

Remember when Anne Lindbergh's book, *North to the Orient*, was acclaimed by the reading world? Fascinating, was the general comment, but an unaware country did not take its meaning to heart for, as Alaska points out, "New York is 1500 miles closer and San Francisco 431 miles closer to Tokyo via Alaska by air, than by any other route. It is indeed destined to become the "Crossroads of Northern Lands."

Alaska and its University do indeed "have a rendezvous with destiny."

HOW HOT ARE THE STARS

(Continued from page 268)

these stars as in the Hydrogen-type stars or stars of type-A. As hydrogen has only one electron to lose, the singly ionized atom cannot absorb light. As more of their atoms become ionized at hotter temperatures the number of hydrogen lines decreases. Hydrogen is such an abundant element in all stars that, even in the hottest stars, some of it remains un-ionized or in a neutral state. The Helium stars have temperatures as high as 25,000 degrees Absolute (44,500 degrees Fahr.) or even higher in some instances.

Hottest of all are the stars known as Wolf-Rayet or O-type stars. They may have temperatures higher than 50,000 degrees Absolute. They are greenish-white in color. They are all in the Galaxy or the Magellanic Clouds. They are massive and have high velocities. Bright bands in their spectra indicate connection with Novae in their final stage, or with planetary nebulas. The name Wolf-Rayet for these stars is for two astronomers of the Paris Observatory who, in 1867, discovered the first star of this type. They have bright lines of oxygen, nitrogen, carbon and helium in various stages of ionization, and these bright lines are superimposed upon a continuous spectrum. In several ways the spectra of these stars resemble those of Novae. They appear to be surrounded by a rapidly expanding gaseous envelope supplied by material streaming outward in all directions from the star, and extremely transparent.

In classifying stars, as outlined above, from the coolest to the hottest and by means of spectral patterns associated with the color and temperature of the star nothing has been said as to the *internal* temperatures of stars. It is known, however, that in the interior of a star the temperature must run into millions of degrees. The release of atomic energy through the transmutation of atoms in the interiors of the stars will provide a source for the radiant energy that the sun and the countless stars of space are expending at such a lavish rate. All other known sources would be totally inadequate to supply such a tremendous amount of energy for the billions of years that even the geological changes that have taken place on our own planet would require. The life of our own sun must have endured for at least *billions* of years to supply to our planet the heat and light that there is evidence it has received through all the ages. The energy released by transmutation of atoms within the interior of the sun is more than sufficient to maintain the sun's present output of light and heat for almost limitless periods of time.

Among the planets in May, Mercury will be in the morning sky and at greatest western elongation on May 22. This is not a favorable elongation, although it may be found low in the morning twilight around this date. Venus is now resplendent in the western evening sky after sunset, the only planet appearing in that part of the heavens and easily recognized by its superior brilliancy. Mars, although in the western evening sky, is too close to the sun to be observed, and passes to the morning sky after conjunction with the sun on May 22. Jupiter now is conspicuous in the morning sky, low in the east before sunrise. It is in the constellation of Pisces. Saturn is now in Virgo, midway between Spica and Regulus. It is in the southeastern sky at sunset and sets after midnight.

THE SHAPE OF ANCIENT SEAS

(Continued from page 238)

Only the present generation of scientists, led by such daring thinkers as Daly, have understood that each thickening of the ice sheets meant a corresponding lowering of the ocean, and that with each retreat of the melting ice a returning flood of water raised the sea level.

Of this "alternate robbery and restitution" most geologists have taken a conservative view and said that the greatest lowering of the sea level could not have amounted to more than 400 feet, possibly only half as much. Most of those who argue that the drawing down was much greater base their reasoning upon the submarine canyons, those deep gorges cut in the continental slopes. The deeper canyons lie a mile or more below the present

level of the sea. If at least the upper parts of the canyons were stream-cut, it seems logical that sea level must have fallen enough to permit their formation during the Pleistocene Ice Age.

This question of the farthest retreat of the sea into its basins must await further searchings into the mysteries of the ocean. We seem on the verge of exciting new discoveries. Now, oceanographers and geologists have better instruments than ever before to probe the depths of the sea, to sample its rocks and deeply layered sediments, and to read with greater clarity the dim pages of past history.

Meanwhile, the sea ebbs and flows in these grander tides of earth, whose stages are measurable not in hours but in millennia, tides so vast they are invisible and uncomprehended by the senses of man. Their ultimate cause, should it ever be discovered, may be found to be deep within the fiery center of the earth, or it may lie somewhere in the dark spaces of the universe.

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State Nature Emblems

State Flowers and State Birds. By Robert Sparks Walker. Litchfield, Illinois. 1951. The Sunshine Press. 61 pages. $3.00.

State Birds and Flowers. By Olive L. Earle. New York. 1951. William Morrow and Company. 64 pages. Illustrated by the Author. $2.00.

Although completely different in approach to the State flower and bird emlems, these two attractive books achieved almost simultaneous publication and arrived for review within two days of each other. Thus they seemed destined for joint report here.

Mr. Walker's approach is poetic. The Tennessee naturalist-author-poet has dedicated an interesting and informative poem to each official flower emblem and to each State bird, official or not. Undaunted by the fact that several States share the same bird, Mr. Walker does a new poem for each State. Thus he is called upon to versify on the cardinal for Illinois, Indiana, Kentucky, and Virginia, and to be similarly resourceful with the meadowlark and bobwhite. He proves equal to the task. His publishers have given him a specially attractive piece of bookmaking in point of typography, paper and binding.

Miss Earle's book is directed to a junior audience and is one of the Morrow Junior Books. Her illustrations are most attractive and set off the simple but informative text most effectively. She is not, of course, able to vary her descriptions of the birds commonly shared by more than one State, and logically refers to that State where she has first discussed the bird in question. Unfortunately she was not aware that Virginia had, by legislative action, officially adopted the cardinal in place of the unofficial robin, but this appears to be her only serious error.

Both authors, of course, have had to accept the unofficial birds of a half-dozen States that do not have any official avian emblem. Minnesota, for example, is now conducting a poll to establish an official bird, which may not be the unofficial scarlet tanager. The two books are complementary, and together should be most useful in school work. We will be happy to be able to recommend them because we receive frequent requests for information on official Nature emblems of the States. Perhaps, also, the books may stimulate interest in the few States where bird emlems have not been officially designated. Flower emblems are all official.

Cutting of Gems

Gem Cutting. By J. Daniel Willems. Peoria, Illinois. 1951. The Manual Arts Press. 224 pages. Illustrated. $3.95.

With the growing army of rockhounds—perhaps we should say "pack" of rockhounds — this book has a ready-made and eager audience. Perhaps no hobby has grown so rapidly in popularity as that of amateur lapidary work. The cult of the lapidary was for centuries a matter of mystery and was shrouded in secrecy. Amateur enthusiasm for minerals and gem stones and their transformation into items of beauty and adornment have changed all this. Amateur lapidaries ferreted out or worked out methods of polishing and cutting, many times the hard way and by trial and error. In this book, a man who took up lapidary work as one of these hobbyists provides instruction. In the past ten years he has become a master of techniques and has, indeed, contributed refinements to the work. Now he has put between covers information that will be of great value to the professional and the amateur, to the student and to the layman who may not even wish to undertake more than the mere collection of specimens. We discover, also, that the book is to be supplemented by a 16 mm moving picture in color, and a set of slides covering the ground covered in the book.

Whales

The Great Whales. By Herbert S. Zim. New York. 1951. William Morrow and Company. Illustrated by James Gordon Irving. $2.00.

This Morrow Junior Book is the eighth in the series of science picture books by Dr. Zim. The text is set in large type for the young audience, and the effective illustrations are placed in juxtaposition to the related text. The result is a fine introductory story of whales and whaling.

Connecticut Council

Thirty-five agencies representing Federal, State and private conservation interests have joined to set up the State Natural Resources Council in Connecticut. The effort of these groups through this cooperation will be to find a basic approach to improved soil, water and forest management. More than 300 delegates attended the organization meeting.

Plant Ecology

The Background of Plant Ecology. By Anton Kerner, translated from the German by Henry S. Conrad. Ames, Iowa. 1951. The Iowa State College Press. 238 pages. $5.00.

Entitled *Plant Life in the Danube Basin*, Anton Kerner's book has generally been regarded as a source book for all later works on plant ecology. The book first appeared in 1863, presenting techniques of observation and description far in advance of the author's day; so far, in fact, that the results of many of his experiments have only recently been substantiated. Dr. Conrad's translation has retained as far as possible both the colorful style of the author and descriptions of plant communities.

MAY IN A NORTH OHIO MARSH

(Continued from page 244)

angrily, perplexedly as he finds himself faced with the most serious problem that he has encountered in his short life — whether to come down head first or hind foremost.

The smallest of the raccoon brood bows out its front legs and, half rising on its hind feet, arches its back and circles one of its brothers with a wrestler's crouch, looking for an opening and an invitation to tussle. The startled squawk of a feeding night heron changes the formidable wrestler into a frightened baby raccoon that flees toward the warm protection of the mother's flank. But the memories of young raccoons for passing fears, like the memories of young humans, are short, and soon he is once again the fierce fellow, scrabbling along the bank after a miniature tree frog, dabbling in the water with his front feet in search of tidbits buried in the liquid darkness that sometimes throws off faint glimmerings, pricking his ears to catch almost inaudible sounds, and feeling the balmy wind of his first May stir the long fur on his back.

BEAR INDIVIDUALISTS OF YELLOWSTONE PARK

(Continued from page 247)

wrestling holds and tussle powerfully, meanwhile biting with teeth and tearing with claws. The contest may last for hours, intervals of truce permitting recovery of breath and the licking of wounds, the end usually being the glum departure of one in acknowledged defeat.

Old Scar-Face, the venerable and warworn king of the bear community at Geyser Basin, was perhaps the best known bear in Yellowstone. His name came from his many marks of ancient battles, among these the stump of a missing ear. Although the average age of a bear is around fifteen years, Scar-Face was thought to be nearer twenty-five. Once a magnificent grizzly of a thousand pounds weight, in his old age he was a gaunt and stiffened wreck of his former self. So well established, however, was his fame as a fighter that his dominion was not contested.

At one of our wood-cutter camps in the Park the men were being pestered nightly by a female grizzly seeking their food. They brought in two Airedales, hoping that the presence of the dogs would deter the marauder — which showed how little they knew about bears. On the very first evening the dogs strayed out into the woods, and, before long, yelps of terror were heard. The men rushed to the door to see the dogs racing toward the cabin, the bear at their heels. In through the doorway leaped the dogs, the bear following, the men departing by a back door in rather bad marching order. One dog took refuge behind the hot cook stove, which the bear upset on top of it. The other dog was cornered and killed with one swipe of a clawed forefoot. Then, without the least show of excitement, the grizzly waddled over to a nearby log cabin, in which hung a quarter of beef. Although the structure was built of eight-inch logs well notched together at the ends, Madam Grizzly, ignoring the door, reared up at one corner and with a few whacks and tugs made a breach in the walls big enough for entrance. Going in, she soon reappeared, carrying the quarter of beef off into the woods.

This incident illustrates the wisdom of the hard and fast rule of the Park, that all dogs must be kept confined or on leash.

The so called "Hold-Up Bears" are all of the more friendly black variety. Bear begging, which became common on the Park roads, was invented by one bear that soon became known as Jesse James. From him many others learned the trick, the most successful ones being mothers with cubs. The designing parent would plant her youngsters in the middle of the road, and as an approaching car slowed up to avoid injury to the brats, she would rear up beside it in a menacing way, waiting for food to be thrown out. When the amount of the donation seemed to her just and proper, a signal would bring the cubs to share the feast. It was not uncommon to see a dozen cars standing in line waiting to get past one of these bear toll gates.

Gradually the Yellowstone bears, especially the blacks, have become more and more dependent upon man for their livelihood. The mother bear, instead of teaching her cubs to stalk, to dig, to fish and to hunt wild fruits, trains them to demand food at the roadside, to prowl for it at night among human habitations and to patronize the garbage dumps. While the young grizzlies are still being taught the ways of their ancestors, even they are coming more and more to rely upon the village waste heaps for sustenance. All are forsaking self support for the easier way.

A question often put to rangers is: "Do the bears ever attack people?" The answer is, "Yes and no."

Like humans, bears differ in temperament. Some remain wild and suspicious of all mankind; others become fairly trustful and gentle. The grizzly is the least dependable. Beware of him always. The black one will not charge except on real provocation, although the mothers are inclined to be touchy about their cubs.

Investigation of complaints of injury from bears shows that wounds are usually slight, and that they had resulted, in practically every instance, from violation of the well-advertised rule against feeding bears from the hand. In spite of all warnings, and a concerted Park Service campaign to stop this, people insist on holding up a candy or a cooky for the bear to grab. The haste and roughness of the seizure often causes scratches and bruises.

There is no blinking the fact that bears are dangerous. Why, then, do the Park authorities allow them at large among the many annual human visitors? A part of the answer is that the people want it so. Animals wild, or partly so, outstrip all other natural objects in stirring human interest. The mighty waterfalls, the prismatic Canyon and the roaring geysers of Yellowstone are instantly forsaken by the sightseer the moment a roly-poly little bear cub appears in the offing. However, be cautious with the bears in Yellowstone Park and elsewhere, and you will be almost as safe as in your own home. And *do not* feed the bears!

CAMERA TRAILS

(Continued from page 271)

treme close-up work, and who desire a medium priced camera, the Bolsey B-Special should be of major interest. The 35mm camera is designed with a removable shutter-lens assembly. By using three extension rings, the photographer can work as close as 3¾ inches and cover an area 1¼ x 1½ inches. Without any extension rings the camera focuses as close as two feet from the subject. The B-Special is supplied with one ring and sells for $71.25, federal tax included. Additional rings cost $5.00 each. Further information can be obtained from the Bolsey Corporation of America, Inc., 118 East 25th Street, New York 10, N. Y.

Eastman has three new offerings for the spring.

The first of these is the Brownie movie camera, said to be the simplest movie camera ever made. In developing it, the company was striving to produce a camera as easy to operate for full-color movies as is the "still" Brownie for snapshots.

The Brownie movie camera features a 13mm f/2.7 lens which is set for universal picture taking, thus making any change of focus unnecessary. The shutter speed is also fixed at the standard 16 frames per second. Thus, the only adjustment necessary is that of lens aperture according to prevailing light conditions. The camera uses 25-foot rolls of double 8mm film, and fully loaded it weighs less than two pounds.

The second product is the Kodak Signet 35 camera, successor to the Kodak 35, which will no longer be manufactured. The Signet has a Kodak Ektar f/3.5 lens, a speed up to 1/300th, a built in eye-level range finder, and focusable down to two feet.

The third product is a Kodaslide Merit projector, priced at $24.50. The machine will accept all standard 2 x 2 inch mounts. These are fed in from the top rather than from the side, as is the case with most projectors. It remains cool while in operation, uses a 150-watt standard voltage bayonet base projection lamp, and can be operated on either AC or DC, 100 to 250 volts. A two-section carrying case is available as an accessory.

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CAVES AS A TOOL IN NATURE EDUCATION*

By Charles E. Mohr,

Director, Audubon Nature Center
Greenwich, Connecticut.

CAVE exploration offers a field of Nature recreation and education that so far has been too little utilized. It may be used effectively for (1) public field trips, (2) expeditions by various organized Nature groups, and (3) investigations by amateur scientists and hobbyists.

There already have been convincing demonstrations of the recreational and educational values of trips to caves. Among some 200 "Expeditions for Everyone," public field trips, sponsored by the Academy of Natural Sciences of Philadelphia have been several trips to caves. They have always been especially well attended; the interest aroused has been long-lasting.

In addition to their usefulness as objectives for group exploration, caves offer an uncrowded field for the individual naturalist and hobbyist. Indeed, a considerable amount of cave exploration and investigation has already been done on an individual basis, by amateurs. Would-be explorers must be cautioned, however, against entering caves alone.

Geographically, caves are so numerous and widely distributed in the United States, that they can play a part in the plans of almost every museum education program, nature group, and individual naturalist.

There are 145 commercially operated caves in this country located in 35 states. Most of them are open the year 'round and offer special inducements to organized groups. For the most part these caves represent the outstanding attractions of the underworld. Their scenic beauty and geologic interest is further enhanced by modern lighting techniques. Paths, bridges, and stairways help to insure the visitor's safety and comfort.

There is, admittedly, more adventure and far more opportunity for real discoveries, in the undeveloped or wild caves. And there are 25 such caves for every commercial cave — at least 3500 in the U. S. No state except Delaware, is totally lacking in caves. Several states count their known caves in the hundreds.

In the East, caves honeycomb the limestone belts that appear in central New York, the southern half of Pennsylvania, and the mountains of Maryland, Virginia, and West Virginia. The last named, West Virginia, alone has more than 400 caves; some of them among the deepest and most extensive in the country.

Southern Indiana, Kentucky and Tennessee, form a second major area, world renowned for its many caves and especially for its blindfish, crayfish, and other specialized forms of cave life.

The gently rolling Ozark Mountains, including a third of Missouri, and parts of Arkansas and Oklahoma, constitute a cave region unsurpassed in geologic interest and wealth of fascinating cave life.

Elsewhere caves in some abundance may be found in the Black Hills of South Dakota, in the hill country of south-central Texas, and in California.

The Nature leader who is considering using caves in his program will find information readily available in certain state reports: West Virginia, Maryland, Texas, and Pennsylvania — with surveys under way in Alabama, Missouri, and California. Popular books have been written about the caves of New England and New York, with another on the Virginias soon to be published. U.S. National Park Service booklets describe eleven caves in Parks and Monuments. A dozen other caves are located in State parks which distribute information about them. An introduction to caves is provided by one of the National Audubon Society's Nature Bulletins, written for teachers.

The National Speleological Society, with headquarters in Washington, D. C., (1770 Columbia Road, N.W.) maintains a file on all known caves, and its publications are valuable references for anyone interested in caves. Its "Directory of Developed Caves" gives detailed information on caves open to the public.

Films provide valuable preview or follow-up program material in connection with a cave visit. "A List of 16mm. Cave Films" has been published by the National Speleological Society. It includes several recent releases, one of them a 55-minute sound-color film on cave exploration. A second film pictures prehistoric cave paintings.

What can the Nature leader expect to find in caves to compensate for the extra effort involved in staging a cave trip?

First, there are definite outcomes that a *large* party of explorers — up to 100 or more — might expect from a visit to a good sized cave:

1. Experiencing the challenge and thrill of penetration into a new and strange world, a "last frontier" near at hand.
2. Awareness of a remarkably uniform environment. Cave temperature, for example, may not vary more than degree or two the year around.
3. Appreciation of the limitations upon plant growth underground. While simple green plants may exist in the "twilight zone" of a cave, only molds and fungi live in total darkness. In commercial caves, however, "artificial sunlight" permits algae, mosses, and occasionally ferns to grow.
4. Understanding of the continuing nature of geological processes; how caves form and formations develop.
5. Discovery of animal life partially or completely adapted to cave environment. Winter brings a unique opportunity to observe *hibernating* animals, for almost every cave shelters some bats at that season.
6. Photographic situations almost totally unlike anything on the surface.

Second, there are additional opportunities for the amateur scientist, in parties of *limited* size. Properly equipped groups can, of course, safely explore the more difficult caves. They can carry out worthwhile projects such as:

1. Adding to the general scientific knowledge of the region. Locating and exploring new caves; studying known caves.
2. Surveying and mapping caves.
3. Tracing underground streams with suitable dyes.
4. Locating and studying fossil remains. Fossils in the bed rock are often clearly exposed and remarkably preserved.
5. Locating and recording archeological material. Safe from the elements, paintings, artifacts, and bones may be preserved for centuries.
6. Making distributional life history studies of bats, salamanders, etc. There are chances for figuring out food chains, recognizing the role of predation, and finding clues to the riddle of the evolution of cave creatures.

Once it is clear that caves are *worth* visiting, that they are reasonably *accessible*, and that *information* about many of them is readily available, it is time to mention, and to emphasize, a few of the *safety measures* and other considerations which should govern the planning and conduct of a cave trip:

1. Make safety considerations paramount. (a) Visit only the easiest, safest caves and only *after advance exploration*. (b) Have the trip especially well organized, with dependable leaders. (c) Require everyone to have *two* sources of light, adequate footwear, etc. People don't get "lost" in caves — they run out of light.

2. Enforce these rules: No defacing of walls or formations. No collecting of animal life. No *un*supervised exploration. No pollution of waters or littering of cave.

3. Instill an appreciation of the property rights of the owner.

4. Seek the cooperation of experienced spelunkers in exploring any caves which may be *difficult* or *dangerous*. (a) Keep the party small but adequate. (b) See that the mission is worthwhile, not foolhardy.

Finally, the National Speleological Society stands ready to assist you in any worthwhile cave visit. With 21 local groups or "Grottoes," and nearly 1000 members, there is almost certain to be an experienced spelunker in your area. You are invited to seek such assistance.

*Part of a talk given by Mr. Mohr at the Annual Meeting of the American Nature Study Society in Cleveland. Mr. Mohr is President of the National Speleological Society, and a Past President of the American Nature Study Society.

Sequoia's Geology

Sequoia National Park; A Geological Album. By Francois E. Matthes; edited by Fritiof Fryxell. Berkeley, California. 1950. University of California Press. 136 pages. Illustrated. $3.75.

This posthumous book is a companion to the almost simultaneously issued volume presenting a geological interpretation of the Yosemite National Park, both books being edited by Dr. Fryxell, old friend and associate of the author. Photographs here provide the interpretation of Sequoia, 124 pictures being presented along with nontechnical, textual interpretation of them. As the publishers say, it is like a conducted tour of the park, geologically, and should be of immense interest to any visitor to Sequoia National Park.

Yale Forestry; Fifty Years

The First Half-Century of the Yale School of Foresty. Edited by S. N. Spring. New Haven. Conn. 1950. 211 pages. Illustrated.

This story of fifty years in forestry education by the Yale School of Foresty was prepared in commemoration of that golden anniversary, celebrated last December. It is the story of the school, its alumni and the accomplishments of both. It is a story principally of interest to foresters, but is also a valuable contribution to forestry history.

American Orchids

Native Orchids of North America. By Donovan S. Correll. Waltham, Mass., Chronica Botanica Co.; New York, Stechert-Hafner, Inc. 1951. 400 pages. Illustrated. $7.50.

This distinguished addition to botanical literature will be welcomed by botanists and orchid specialists. Its author is with the United States Department of Agriculture, and he has enjoyed splendid artistic collaboration from Blanche Ames Ames and Gordon W. Dillon, who contributed the excellent plates. The publishers have added artistry to an essentially botanical text.

Spade Work

Surgery with A Spade. By A. Z. Godunov. Lynchburg, Virginia. 1949. J. Morrison and Sons. 32 pages. Illustrated. $1.00.

This is an entertaining little book telling how not to use a spade in connection with growing things. The author lets the plants and trees tell the reader how to treat them, and in the doing they present some useful garden information. Any gardener would enjoy it.

Indian Beadwork

American Indian Beadwork. By W. Ben. Hunt and J. F. "Buck" Burshears. Milwaukee, Wisconsin. 1951. The Bruce Publishing Company. 63 pages. Illustrated. $5.00.

Following a short history of Indian beadwork, the authors describe methods and give directions for reproducing this kind of ornamentation. There are thirteen full-page four-color plates giving sample designs for use on all parts of the costume. This is a most interesting and useful how-to-do book.

Flamingos of France

The Flamingos of the Camargue. By Etienne Gallet. New York. 1951. The Macmillan Company. 127 pages. Illustrated. $3.00.

One of the few spots in the world today where any species of flamingo appears to be holding its own against the depredations of civilization, is in the delta of the Rhone River in France and that area known as the Camargue. The author of this book, a resident of Arles, has studied and photographed these interesting birds, *Phoenicopterus ruber roseus*, and in this volume presents their story and 53 photographs of his own taking.

Desert Life

Our Desert Neighbors. By Edmund C. Jaeger. Stanford, California. 1950. Stanford University Press. 239 pages. Illustrated. $5.00.

For some forty years the author of this book has explored the deserts of North America, and this is the latest book to come from his pen on that extensive experience. Earlier he has dealt with the deserts themselves, and with the cactuses and wild flowers found there. In this most recent book Mr. Jaeger writes of the birds, mammals and some of the reptiles of his desert wanderings. He always writes both entertainingly and informatively, and the reader explores desert areas with him.

The James River

The James River Basin; Past, Present and Future. Compiled by the James River Project Committee of the Virginia Academy of Science. Richmond 11, Va., Box 1395. 1950. Virginia Academy of Science. 843 pages, with illustrations and maps. $6.00.

This monumental, valuable, interesting and comprehensive work is the result of collaboration by a considerable group of specialists, and carries a foreword by Marcellus H. Stow, chairman of the Academy's project committee under whose aegis the book is brought out. Main chapters deal with conservation, recreation and education; biological sciences; earth sciences; mathematical and applied sciences; industry and transportation. Under each chapter heading specialists have contributed sub-chapters. The main heading on biological sciences, for example, covers botany, plant pathology, entomology, mollusks, marine fishes and invertebrates, freshwater fishes, amphibia and reptiles, birds, mammals and medical sciences. It would seem that nothing one would wish to know about the historic valley of the James has been overlooked in this splendid volume, which is available at an amazingly low price for these days.

Hugh Bennett

Big Hugh: The Father of Soil Conservation. By Wellington Brink, with a preface by Louis Bromfield. New York. 1951. The Macmillan Company. 167 pages, with frontispiece of Hugh Hammond Bennett. $2.75.

In a preface to this little biography of Hugh Hammond Bennett, Chief of the United States Soil Conservation Service, Louis Bromfield paints a word picture of the transformation that has taken place on uncounted thousands of acres of crop lands — a transformation from soil erosion to soil production. "I doubt that this could have been accomplished without the leadership and wisdom of Hugh Hammond Bennett, "writes Mr. Bromfield. "Certainly, without him the progress would have been infinitely slower." And in the story of the life of Big Hugh the author paints a word picture of the man who has carried the banner of soil conservation, who preached to an audience that largely turned deaf ears until the dramatic tragedy of the Dust Bowl of the mid-thirties cured the deafness. Anyone who has heard Hugh Bennett from a platform, who has talked to him across a desk, who has been with him outdoors appreciates the missionary zeal with which he fought for a program of soil conservation. Now, through this book, there is opportunity to know him better and to evaluate the contribution he has made during the past fifteen years in the country's history.

Carolina Fisheries

Survey of Marine Fisheries of North Carolina. By Harden F. Taylor and a Staff of Associates. Chapel Hill, N. C. 1951. The University of North Carolina Press. 555 pages. $10.00.

The title of this book is descriptive of its scope, although it also presents a comprehensive view of the economics of national and world fisheries. The book is divided into three parts. The first is a discussion by Nelson Marshall of the "Hydrography of North Carolina Marine Waters." The second part is devoted to the "Biology and Natural History of the Economic Species," and includes sections on the menhaden, edible finfishes, the oyster and other mollusks, the shrimps, the blue crab, the diamondback terrapin and the seaweed resources. The third part of the book covers the "Economics of the Fisheries of North Carolina," written by Mr. Taylor.

Woodworking

Making Useful Things of Wood. By Franklin H. Gottshall. Milwaukee, Wisconsin. 1950. The Bruce Publishing Company. 192 pages. Illustrated. $4.50.

This is a practical book for those who enjoy working with wood. Simple projects of good design and requiring good craftsmanship are presented with descriptions, plans and pictures of the finished product.

UNDER THE MICROSCOPE

By JULIAN D. CORRINGTON

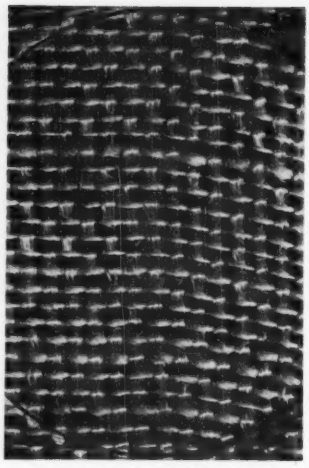
WARP AND WEFT

MOST of our excursions into the land of Lilliput follow the biological highway, but there are other roads and occasionally we try one of these to see what of interest may be encountered. Not for some time have we explored the textile trail, which begins on the biological, diverges into the applied route, then leads on to join another footpath coming from the mineral kingdom turnpike. For textiles derive from *fibers*, which are either animal, vegetable, or mineral in composition, are spun into *threads* or *yarns*, and these are manufactured into *fabrics*, a word that formerly designated anything made by putting materials together, but now restricted to cloths. Commonly, the various procedures for making these fabrics are lumped as *weaving*, but technically there are six textile structures, only the first of which is made by true weaving.

If you will examine a handkerchief, hand towel, pillow case or sheet with a hand magnifier, you will observe a construction similar to that in one of our accompanying illustrations, designated *plain cloth*, an example of weaving. Put the lens on milady's stocking, however, and you will be looking at *hosiery fabric*. A man's hat will demonstrate *felted fabric*, and three others, to be considered later, are *plaited*, *netted*, and *lace fabrics*. Thus woven material, properly named, is only one of six kinds of goods on a basis of method of manufacture, although, to be sure, by far the most important one.

Spinning and weaving are ancient arts. In Caucasian countries they have been so intimately associated with the work of woman that the spinning wheel has been

Felted fabric, 25X.



Plain cloth, a woven fabric, 15X.

one of her symbols. We still speak of the spindle or distaff side of the family, as distinguished from the spear or crosier side, in law and literature. In Africa, on the contrary, while women may spin, they may not weave, the loom being the prerogative of the male. Many articles and volumes have been written on the history of spinning, of weaving, and of looms, the modern technology of textile mills, of power looms, and other related topics.

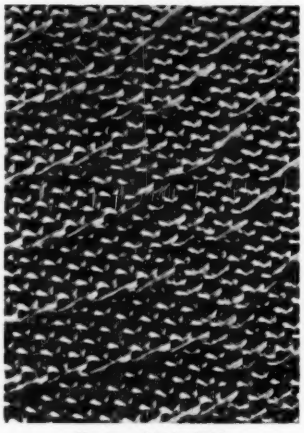
The simplest design in weaving is to arrange a series of parallel longitudinal threads, called *warps*, then to intersect these at right angles with a second set of parallel horizontal threads known as *wefts* or *woofs*, each weft passing successively under then over the series of warps. If the two series, warps and wefts, are equal in number, passing alternately under and over one another, and are of approximately the same size and spacing, the fabric is known as *plain cloth*, the basic design of all weaving. Numberless variations on this regulation theme are possible. Alternating thick and thin warps and wefts produces a corded goods termed *rep* or *repp*. Either warps or wefts may be skipped according to some plan of weaving, as when each weft skips over two successive warps, then passes under the third, or passes over five and under two. Endless variety of this sort exists in fabrics called *twills*, the skipping resulting in diagonal patterns. By having, say, every fifth or tenth weft differ from the rest in composition, size, texture, or color, many designs may be woven into the goods, such special wefts being known as *pattern threads*. We shall pay further attention to variations in weaving in later articles.

Felted fabrics are made by an entirely different scheme. Fibers are matted (*felted*) together into a firm and resistant mass by wetting, then rolling or pressing under heat and with a sizing matrix. The commonest uses for felted goods are for carpets and hats, and the fibers are mostly wool, hair, and fur, often in mixtures, as wool and fur. A glance at the illustrations will show that felted and woven fabrics are utterly different in plan of manufacture.

Hosiery-type fabrics are made by a process of knitting rather than weaving, and consist of a series of intersecting loops. One grows dizzy trying to follow the course of a single thread through the cloth. In the illustration, a pattern thread occurs every fourth row. Used in making stockings, this method is also widely employed in other fabrics, as for slips, undergarments, T-shirts, rayon-jersey dresses, and others.

A study of this sort may be made by anyone, privately or in an organized class, and as a project or hobby. Textile microscopy is largely a form of applied biology and makes excellent collateral material for science classes or individual or club project work. A collection of slides of fibers, threads and yarns, and fabrics, is both instructive and interesting.

The first type of slide we shall discuss is a composite specimen mount, as simple to make as kindergarten tasks. In addition to the textiles, all one needs is a supply of clean slides and cover glasses, a clearer, and any mounting medium. Today the mountant is apt to be a neutral synthetic resin rather than Canada balsam. Each maker has his own trade name for these, as *Clarite*, *Permount*, *Harleco*. A small square, ½ or ¾ inch, of the selected fabric is cut from the goods with scissors; a few of either the warps or wefts are teased away from one edge or, if of material differing by any factor, both warps and wefts are removed from two contiguous sides. Next a few of the threads thus exposed are clipped away with scissors so as to make room for the fraying out of one or two; tease with a fine needle so as to expose the individual fibers. The result is a square of fabric with threads protruding from one



Hosiery fabric, 15X.

or two sides, and with one or two of these threads frayed to exhibit individual fibers.

The piece is then soaked in xylene, or toluene, or other clearer, according to the solvent used with the particular mountant at hand, and when most of this fluid has evaporated, but while the fabric is still wet, one large or two small drops of the mountant are applied and the cover glass laid on. The slide is next stored in flat position until the mountant has set firmly, requiring minutes, hours, or days, according to the mountant used; then it is cleaned, polished, and labeled. Such a composite mount shows fabric, threads, and fibers under a single cover, and may be observed or photographed by either transmitted or incident (reflected) light, or both at once, or by darkfield, or polarized light. The widefield binocular microscope is especially well adapted for visual work in this study. Photographs may be black and white, as instanced by the illustrations herewith, or in color, or stereo; they may be displayed and used as prints, transparencies, or lantern slides for projection. In fact, these textile slides comprise a splendid set of subjects with which to experiment in learning all of these methods and techniques. Other mounts, staining, and sectioning will be described later.

SONGS FOR THE COMPARATIVE ANATOMY LABORATORY

BUSTEE'S LAMENT

(Air: *Give My Regards to Broadway*).

Give my regards to Squalus,
Remember me to Felis Cat.
Tell all the gang
Up in the laboratory
Teacher told me, "Scat!"
Tell them of how I busted
On Latin names I can't recall.
Give my regards to skulls and bones
And say that I'll be back next fall!

SCIENCE SHOPS

2. Carolina Biological

The baby among major biological supply houses in America is Carolina Biological Supply Company, situated near Greensboro, in the North Carolina piedmont. This firm was founded in 1927 by Dr. Thomas E. Powell, Jr., who was then teaching geology and biology at Elon College, in the town of Elon College, which is the postal, express, and freight address of Carolina Biological. Contrary to a belief fostered by this address, there is no connection between the Company and the College.

It appears that Dr. Powell began thinking of the possibility of a biological supply concern at this location as early as 1923, but that he actually opened operations four years later, "starting business from a mudhole," as local lore would have it. As is apt to be true of any one-man, sideline, part-time enterprise of this nature, there was little capital, just a tiny shack, 14 x 16 feet, but lots of faith, energy, and ambition. The founder has since said that he thinks it was fortunate that the first year's business ran less than two thousand dollars, as he thus discovered he had to grow slowly, developing the know-how as he went, but nonetheless reassured as to the future.

The second year saw the purchase of the present site, the erection of a 20 x 40 laboratory room, and the part-time employment of three college teachers and several students. In 1929 additions were made, and, in 1933, J. B. Brown became the first full-time regular staff member. Buildings were added from time to time, and a new member to the personnel every so often, reaching seven by 1942. The company incorporated in 1938, dissolved two years later to become a partnership, then incorporated again in 1947.

Today Carolina Biological owns 140 acres of land containing biological farms, ponds, and laboratories. There are eight buildings and a staff of thirty-four. The current catalog is a handsome volume of 456 pages, copiously illustrated, listing and describing thousands of items; the index, which does not include chemicals or separate listings of kodachromes, slides, and the like, has more than 2500 entries. The Departments of the firm are Botany Slide, Chemical, Culture, Embryology Slide, Plast-O-Mount, Preserved Material, Zoology Slide, Office, Buildings and Grounds.

Among important milestones in Carolina's history, the establishment of each of these departments on an independent basis must be given prominence. First came Preserved Materials, the backbone of every similar business, then Microscope Slides, subsequently partitioned into three separate departments. From the very first year of operation Dr. Powell devoted much time and attention to the preparation and maintenance of living cultures, gaining an enviable reputation for the excellence and dependability of this service within a short time. Starting with the inevitable *Amoeba proteus*, other protozoans were added, then *Hydra* and *Planaria*. Now more than 385 cultures and live items are listed, including 31 protozoans, 62 invertebrates, 41 *Drosophila* mutations, 33 vertebrates, 107 bacteria, 36 fungi, 26 algae, and 52 higher plants. As accessories for this extensive business, the establishment carries aquaria and terraria, such culture media as desiccated flies for growing the water mold *Saprolegnia*, sheep manure (one-ounce jar, $0.25) to maintain *Daphnia* cultures, Carolina spring water, white quartz gravel, acid soil for growing the insectivorous plants, Venus Flytrap and Sundew (collected near Wilmington, N.C., the only place in the U. S. where Flytraps grow), sterile *Drosophila* medium, sterile potato plug medium sup-

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plied in bacteriological culture tubes, and so on and on through a long list. What these biologists won't order! In 1942 the Company pioneered by furnishing pure clone cultures — that is, all of the specimens in the culture derived from a single parent through asexual propagation, hence a pure line. A year later, the Culture Department became a separate division of the business.

During the first two years difficulty was experienced in providing marine specimens. Always in great demand, such animals as *Squalus* and *Asterias*, for example, had to be secured from other firms, Carolina merely jobbing the order. Failure of this arrangement necessitated branching out into marine collecting on their own, a development that took place in 1929-1930, and from then on the piedmont institution emerged as a full-fledged biological supply house and a serious competitor of previously established companies.

In 1943, because the local supply was becoming exhausted, three of the staff went to Louisiana to prospect for suitable collecting sites for bullfrogs, turtles, crayfish, and other animals. These people settled upon Schriever, in the Delta country, and two years later Carolina bought up a settlement project from the Federal Government known as Waubun, consisting of four tracts with a total of 26 acres of land and buildings, including two laboratories. Mr. Brown went there as biologist in charge and now has his own staff. Waubun Laboratories incorporated and became a separate unit and is now operated as a wholesale biological supply station, furnishing not only the frogs, turtles, and crayfish mentioned but also alligators, lubber grasshoppers, clams, pigeons, and many marine fish and other special items supplied on order. Investigators whose interests are in fishes, amphibia, or reptiles of the region are invited to use the facilities of the Waubun Laboratories.

Carolina publishes an excellent house organ, *Carolina Tips*, which, as the name indicates, endeavors to provide a medium for practical teaching and laboratory hints and tips. This little journal consists of four pages, issued eight times a year, and is now in its fourteenth year. It is neither as elaborate and extensive as some, nor as commercial as certain others. The four pages contain little or sometimes no advertising, but constitute a goodwill offering or liaison agent between the Company and its patrons. In addition to minor articles, *Tips* has carried a major contribution in the form of the late C. S. Brimley's series, "Amphibians and Reptiles of North Carolina," and "Mammals of North Carolina," including important keys. These are now available in book form. At present a useful and interesting series on "Biologically Important Animals," written by members of the staff, is appearing. Carolina's emblem, reproduced herewith, depicts a squid within an oval.

In 1927 Dr. Powell attended to correspondence, filled and shipped orders, put up preserved specimens, and grew cultures, all in his spare time. Today he has no specific departmental routine but, as president of the corporation, oversees and coordinates the entire plant. The staff includes a liberal sprinkling of career men and women with doctor's and master's degrees, and of personnel with long experience in their respective specialties. Next year, when they celebrate their 25th anniversary, members of this firm may look back with pride at the many accomplishments over this short span, as well as contemplate an even brighter future.

REVIEWS

Biology

IN *Biology: The Human Approach*, Dr. Claude A. Villee of Harvard has produced a splendidly written and handsomely illustrated book whose concepts appeal to us as admirable. He takes as his main premise that, since all organisms have to solve the same problems of metabolism and reproduction and that in so doing other systems may be affected, it is essential to use the comparative and evolutionary approaches in order to understand an organism such as man. There must be emphasis on the physiological and chemical aspects of life to comprehend how living beings function and how they came to be as they are. The author believes the treatment should neither be so overloaded with facts as to discourage and repel the general student nor so emasculated and superficial as to affront his intelligence.

In the main these objectives have been carried out, and the writing is above-average in clarity and interest. Yet we feel that Dr. Villee has failed to live up to his promise of not overloading the general student with facts. We have objected before now in these columns to high school texts that borrow extensively from the college level, and to freshman-class college texts that incorporate material belonging to upperclass levels, the authors not knowing where to stop. In our opinion the cramming of page after page of cold facts, condensed to the point of losing all reader appeal, and skimming the cream off half-a-dozen advanced courses that should be taken only by those students who wish them and in due turn, is not suitable organization for the general student's one and only contact with the subject. It will be argued that such a student must get it there or not at all, but why should a *general* student be exposed to or have any interest in these advanced details? One who really mastered this book would find further work in physiology (in the next course) unprofitable, and much of embryology and genetics uninteresting.

This is more of an opinion than a criticism, and certainly it is better to have too much than too little in the adopted text. Teachers can omit sections as they please. The emphasis on human biology is, we believe, the proper one for the beginning course. Pp. xv, 580; figs. 250. W. B. Saunders Co., W. Washington Sq., Philadelphia 5, 1950. $5.00.

Chemistry

THE same fine plan and expert authorship noted in Linus Pauling's *General Chemistry* (reviewed in the Jan., 1949, issue) marks his more recent *College Chemistry*. The newer work keeps to the fundamental principles of the earlier one, but is written for the general student rather than the chemistry major, and "in a more slowly paced, less mathematical form." There is a new chapter on biochemistry, and a new exposition of color photography with two excellent color plates. Many sections are the same in the two books, many are entirely new; many of the fine drawings of Roger Hayward are the same, but there are also many that are new. *College Chemistry* has a more attractive format and makes a better appearance. We would have been happy (as we see it now in retrospect) could we have been instructed in chemistry by means of either book: today's students probably won't realize it, but they are fortunate in having this opportunity. Pp. x, 705; figs. 209, 2 in color. W. H. Freeman & Co., 549 Market St., San Francisco 5, 1950. $4.50.

Camping

WE WERE much interested in reading *Camp Counseling*, by Mitchell and Crawford, a well planned and heavily documented book of lore and know-how on camping. The volume will appeal to directors, counselors, and other personnel of summer camps, as well as to older campers, scoutmasters, and others concerned with camp work.

Yet we were disappointed, too, in that Nature study is so feebly and poorly represented. There is a wealth of material on arts and crafts, and you can find adequate and illustrated directions on tenting, directing dramatics, swimming, whittling, knots, cooking, tincandicraft, and hundreds of other enterprises, but we believe the authors made a serious mistake in not taking a biologist into co-authorship, for they wrote nothing on what should be a major subject in the book. In fact, the chief sources are not even listed in their otherwise compendious bibliographies. We looked in vain for any mention whatever of the American Nature Association, of *Nature Magazine*, of Dr. E. Laurence Palmer's celebrated educational inserts, of Cornell Leaflets, of Peterson's bird guide, of Pettingill's manual for bird study, and so on and on through many items generally regarded as musts by most students of the subject. Some of these omissions are inexcusable.

Otherwise the book represents an immense amount of work and brings together much useful information. There is much of the professional educationist and child psychologist about the writing, the latter amply justified, and at least one of the authors splits her infinitives on every possible occasion; yet there is much charm, too, in the writing, with the use of the homely and familiar in phrasing, anecdote, example, and poem. Pp. xiv, 388, fully illustrated. W. B. Saunders Co., W. Washington Sq., Phila. 5, 1950. $4.25.

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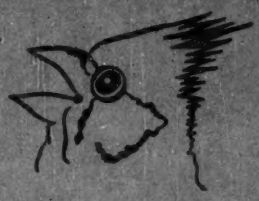

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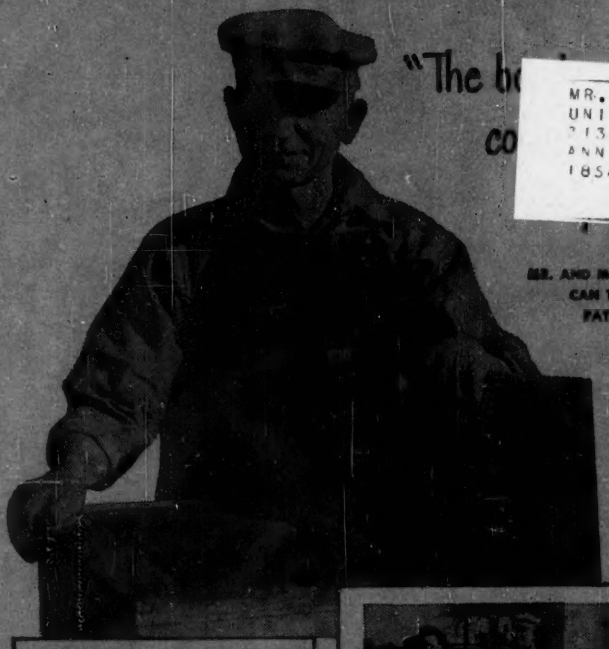

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